FIELD CROP ABSTRACTS

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REVIEW ARTICLE

WILD OATS

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INTRODUCTION

This review article is intended to summarize some of the more important information on wild oats, especially that which appears to have a direct bearing on control measures. The species of wild oat presenting serious weed problems are *Avena fatua* L. (Malz.) and *A. ludoviciana* Dur. (known also as *A. sterilis* (L.) Malz. ssp. *ludoviciana*) and it is these two species which are considered. Most study has been given to *A. fatua* since it is much the more widely distributed.

Wild oats have been associated with cereal cultivation since the Bronze Age. *A. strigosa* has been identified in certain Bronze Age remains and *A. fatua* in Iron Age remains of the Hallstadt period (Malzew, 1930). It may be significant that the cultivation of oats (*A. sativa* ?) did not commence until the early Christian era. Many of the classical writers of Roman times complain of the wild oat as a serious weed of cereal-growing at that time. Malzew (1930) has listed these references.

Few have found any virtue in these species : that any have done so may seem surprising. Nikitin (1938) refers to the sowing of *A. ludoviciana* with certain other plants in order to improve the winter pastures of S. Tajikistan. Dickey and others (1948) report on the contribution of *A. fatua* to the annual grass ranges of California. *A. fatua* has also been used in plant breeding to a limited extent. The parentage of Marvellous, introduced by Gartons in 1921, was (*A. fatua* × Grey Winter) × (*A. fatua* × Goldfinder). Marvellous has been used as a parent for S147 and the recent hybrids Deva and Aa 725.

Christensen and Hopper (1938) studied the feeding value of wild oat grain (presumably *A. fatua*). The samples they examined had 15·5% crude fibre, 61·6% total digestible nutrients and 9·6% digestible protein, compared with figures for cultivated oats of 10·3, 69·2 and 9·6, respectively. Clearly oat samples vary and these figures therefore are subject to considerable variation. As a feed, ground wild-oat screenings may be sold under somewhat disguised names, for instance " mill oats" in the USA. Pigeons are known to consume large quantities on occasion, 1,355 wild-oat seeds being the largest number found in the crop of one of a number of birds shot during the early winter (*East Anglian Daily Times*, 1955).

OCCURRENCE

Wild oats occur widely as a weed of cultivated land in many of the temperate zones of the world. Wood (1953) reports that no less than 61 million acres out of an area of 106 million acres were infested in part of the Great Plains region of N. America. On the other hand Friesen and Mackay (1949) report that over parts of Eastern Canada wild oats do not become established although seed is regularly introduced. According to Lindsay (1952, 1956) *A. fatua* ssp. *fatua* (Malz.) is the commonest species in Western Canada although *A. fatua* ssp. *cultiformis* occurs occasionally. In Russia, also, this weed is widely distributed. Malzew (1930) reports that in the median and northern latitudes *A. fatua* is generally distributed, whereas in the south the species *A. ludoviciana* also occurs widely.

Many authors report the occurrence of the weed in N. Europe ; of particular note are the thorough surveys of Schaeffler (1950) in Germany and of Thurston (1954b) in England and Wales. That wild oat is present in at least parts of S. Europe is made clear by Bonaventura (1951) and Grimaldi (1946). It is also present in Scandinavia (*Svensk Frötidning*, 1948 ; Von Hofsten, 1950 ; Petersen, 1949). *A. fatua* is not entirely absent from Australia (Myers and Moore, 1952).

Schaeffler draws attention to the importance of soil type, climate, the incidence of severe winters, land configuration and even of land-tenure systems in determining the incidence of this weed. Likewise Thurston draws attention to the frequent presence of wild oats in the wheat- and barley-growing areas of England and Wales, *A. fatua* being recorded in 37 counties and absent in 6. This species was recorded widely in the survey in both winter- and spring-cereals (as well as in various root crops) and it occurred on all soil types.

Thurston (1954b) reports that *A. ludoviciana* appeared to be confined in England almost wholly to an area in the South Midlands and Home Counties and quotes C. E. Hubbard of Kew, who first recorded the species in that area near Abingdon, Berkshire, in 1926. It was previously recorded at Falmouth Docks in 1914 and Hythe Quay, Essex, in 1917. It seems likely that it was first imported from France during the 1914–18 war, having been common in S.W. France for some time previously (Chevalier, 1925).

While it is as an impurity in cereal grain that wild oat is most commonly found in commerce, it is also found in flax, oil seeds, grass, maize, sorghum and various feed by-products (Nilsson-Leissner, 1956). Broad (1952) reports that *A. fatua* was present in England and Wales in a significant number of seed samples of wheat, barley and oats during 1928–52 but was not recorded in rye until 1947 : it may be significant that it was about 1947 that King II, the first short-strawed Scandinavian variety, became popular in the UK.

While many present-day writers stress the widespread nature of the weed problem and list it as of major significance, it was clearly also a serious problem 200 years ago (Ellis, 1750). Wild oats are mentioned in several of the County Reports to the Board of Agriculture at the end of the 18th, and beginning of the 19th, centuries. They appear to have caused concern to the authors of the reports for Bedfordshire (Batchelor, 1808), Essex (Young, 1807), Banff (Souter, 1812) and Northumberland (Bailey and Culley, 1797).

Biology

Both *A. fatua* and *A. ludoviciana* are annuals and spread by means of seed although there is some evidence (Kirk and Pavlychenko, 1932) that cut wild-oat straws can under certain conditions propagate vegetatively.

Origin

Both *A. fatua* and *A. ludoviciana* are hexaploids (2n = 42) like the cultivated oat *A. sativa* (Darlington *et al.*, 1945). It was thought at one time that *A. fatua* was the wild parent from which *A. sativa* was derived. This has been disputed by Coffmann (1946), who expressed the view that *A. sterilis* may have been the parent of all hexaploid species ; some support is given to this theory by the recent production from *A. sterilis maxima* by Griffiths and Johnston (1956) of fertile mutants closely resembling *A. fatua* following exposure to X-rays. Fatuoids (false wild oats) have been frequently recorded in cultivated varieties. Authorities differ in attributing the origin of fatuoids to gene mutation, to chromosome aberration, or to natural crossing between wild and cultivated oats. The literature was reviewed by Aamodt, Johnson and Manson (1934) and by Hector (1936). More recently Coffman and Stanton (1940) observed but little dormancy in fatuoids derived from non-dormant varieties of oats ; since hybrids of *A. fatua* normally show some degree of dormancy they infer that hybridization is unlikely to account for fatuoids. Thurston (1951c) suggests that fatuoid production may be influenced by inadequate nutrition of the parent plants. Sverkunov (1950) has recently reported the occurrence, in a stock of a naked variety of *A. sativa*, of plants identical with *A. fatua* under conditions preventing cross-pollination.

Taxonomy and morphology

There is an extensive literature discussing th classification of the genus *Avena*, but no recen comprehensive study using modern cytogeneti methods. A detailed description of the species c wild oats is given by Malzew (1930), by Hecto (1936) and by Ullmann (1953), and more briefl in standard Floras. The main points of structur distinguishing wild from cultivated oats are (a) th presence of an oval callus scar at the base of a least the first grain in the spikelet, (b) the dens pubescence of at least the base of the grain and (c the presence of stout, long, geniculate awns.

Most authorities (e.g. Thurston, 1954b Ullmann, 1953) distinguish *A. ludoviciana* fron *A. fatua* by the presence in the latter of an abscissio scar at the base of each seed ; the seeds are there fore shed singly. In *A. ludoviciana* the seeds in spikelet fall together and force is needed to separat them since only the first seed has an abscission sca the second and third seeds being joined to the firs and second, respectively, by a stalk. While th division is generally true, Thurston (1953) poin out that if spikelet characters are regarded a diagnostic between *A. fatua* and *A. ludovician* there is some overlapping in other character Some wild oats, which she believes may be c hybrid origin, cannot be included in either specie

Physiology

Apart from the morphological differenc between wild and cultivated oats, the weed speci differ from *A. sativa* in shedding their seeds as the ripen, in the sensitivity of the stout geniculate awn to atmospheric humidity, and, especially, in som or all of the seeds remaining dormant for a longe period after ripening. This shedding of seed of wil oats has been recognized since classical times. It due to the presence of the abscission scars at th base of each seed (*A. fatua*) or of the whole spikel (*A. ludoviciana*). Flowering of wild oat plants in crop may extend over several weeks and som seeds will begin to fall before most grain crops ar ready to harvest ; wild oats may shed before the are fully ripe (Malzew, 1930). The mechanis leading to abscission does not appear to have bee studied critically.

The strong twisted awn on the lemma of wil oat seeds responds to changes in humidity b bending. This hygroscopic action takes place wit considerable force and may often push the she seed under clods or into cracks in the soil. I certain wild species (e.g. *A. longiglumis* Du *A. ventricosa* (Balansa), Malz.) the grains can eve be forced into compact, uncultivated soils (Hecto 1936).

Dormancy is shown by the seeds of almost a wild oats : exceptions are *A. fatua* ssp. *cultiform* Malz. and *A. strigosa* (Schreb.) Malz. Dormanc usually lasts for at least a few weeks, but this ma

be extended to several years. It is clearly a valuable mechanism, not merely in permitting the species to survive cleaning crops but in preventing early autumn germination in climates where frost would kill any seedlings produced (Kostjučenko and Belozerova, 1944). In *A. fatua*, dormancy is due to the impermeability of the seed coat to oxygen (Atwood, 1914) but the response of dormant seeds to oxygen may depend on the stage of after-ripening they have reached (Bibbey, 1948). Johnson (1935) reported that the first seeds in the panicle to ripen have a shorter dormancy, and Eichfeld (1944) reported that seeds from the base of the panicle have more permeable seed coats, than those from the upper part.

While oxygen supply is the primary factor controlling the germination of *A. fatua*, other conditions have some effect, e.g. the length of time since seeds were harvested (Johnson, 1935 ; Coffman and Stanton, 1938), storage conditions of the dry seed (Bibbey, 1948), the temperature at which moist seeds are held (Thurston, 1955). Dormancy of *A. fatua* in the field may be affected by factors such as organic matter status, cultivations and the depth of seeds in the soil ; the last presumably influences both temperature and aeration. Thurston has reported (1950a, 1951a) that dung has tended to break the dormancy of *A. fatua* in both field and laboratory tests. It is not clear whether rotting of the seed coat by soil micro-organisms accounts for this effect but Thurston (1951b) points out that the peaks of germination of *A. fatua* in the field at Rothamsted in autumn or late spring roughly coincide with the peaks of activity of soil bacteria and protozoa.

Bibbey (1935) originally showed that cultivation could stimulate germination. Thurston (1951b) has confirmed in pot experiments that monthly cultivation has the same effect. In frequently cultivated soil the maximum survival of *A. fatua* was 3 years in pots and slightly longer in the field. On the other hand, in a later field experiment designed to study germination in relation to sowing depth and cultivation, only 20% of the seeds germinated in the first 4 years (Thurston, 1955). Prolonged, undisturbed burial appeared to induce dormancy (Thurston, 1956).

In *A. ludoviciana*, despite a very similar anatomical and microchemical structure of the seed coat (Thurston, 1950a), other factors than oxygen are important in their effect on germination. In the presence of an adequate supply of oxygen to the seed, the first and second seeds of *A. ludoviciana* germinate most readily at a steady temperature between 45°F. and 55°F. ; higher temperatures, or fluctuating temperatures, reduce germination. At a steady temperature just above freezing point almost all first seeds of *A. ludoviciana* germinated but none of the second seeds (Thurston, 1952).

In the experiments referred to under *A. fatua* (Thurston 1951b, 1955), *A. ludoviciana* seeds survived only 2 years in pots, but in the field a few seedlings were still being obtained in the fourth year after sowing. Under Rothamsted conditions *A. ludoviciana* germinates only in the winter months, between October and March.

Parasites

Wild oats are, in general, susceptible to the same range of diseases as *A. sativa*. More work has been done on *A. fatua* than on the more localized *A. ludoviciana*, but where both weed species have been compared critically with *A. sativa* (e.g by Vavilov, 1914, quoted by Malzew, 1930) all three species generally react in a very similar way to parasites. The occurrence on wild oats of a parasite of cultivated oats does not necessarily indicate that the weed is an important host in the biology of that parasite.

(i) *Fungi.* Both *A. fatua* and *A. ludoviciana* are susceptible to *Puccinia graminis* Pers., *Erisyphe graminis* DC., *Ustilago avenae* Pers. Rosta and *Puccinia coronata* Corda. (Vavilov, 1914, quoted by Malzew, 1930).

There is no published record of wild oats having been infected with *Cercosporella herpotrichoides* Fron but infected plants have been observed twice in England (Macer, private communication).

(ii) *Insects. A. fatua* is a host of *Oscinella frit* Linn. (Cunliffe, 1929).

(iii) *Nematodes. A. fatua* is a host of the eelworms *Heterodera major* Schmit (Thomas, Brown and Willis, 1946) and *Ditylenchus dipsaci* Kuehn (Steiner & Buhrer, 1932).

Nutrients

There is no evidence of any major difference between wild and cultivated oats in their reaction to soil acidity (Thurston, 1951b), nitrogen supply (Thurston, 1951a) or manganese deficiency (Thurston, 1951c) although the symptoms of grey speck disease shown by *A. ludoviciana* are different from those shown by *A. fatua* or *A. sativa*.

Competition

Wild oats hinder farming in three main ways. Firstly, by reducing the yield of the crop which they infest, viz. cereals ; secondly, by demanding special or extra cultural operations so that normal farming practice may proceed viz. singling seedling sugar-beet, and thirdly by lowering the value of seed or grain products. The extent of the two last effects of wild oats is measurable but any such measure is of little value for the purposes of generalization. An overall estimate of the cost of wild oats to the farmer would be of more value. The extent to which, and the circumstances in which, competition affects yield needs to be known, but remarkably little critical work appears to have been done on it.

Canadian workers (Ottawa, Central Experimental Farm, 1950) give some indication of the effects of competition in (spring ?) wheat which followed various cleaning crops and cultural operations over the previous three years. Wheat with a 25% stand of wild oats following fallow yielded 34·6 bu./ac. whereas the crop, also after fallow, with only 0·31% infestation yielded 49·5 bu./ac. Such data as presented, although not very critical serve to confirm competition as a factor of major importance.

Grimaldi (1946) studied the effects of competition on wheat infested with wild oats and vetches, together and separately. He shows that there is a 10% reduction in yield of wheat as wild oats (in the grain sample) increase from 0·5 to 1% and then a further reduction of 10% as the infestation reaches 8%.

Åberg (1957) gives some data on competition between wild oats and peas in relation to chemical weed control. He also states that a considerable amount of work has recently been done in Sweden on the subject of competition which is to be reported in 1957 in *Vaxtodling* and *K. LantbrHogst. Ann.*

The critical evidence on the effects of competition is at present extremely weak. It is to be hoped that the current Swedish work will provide useful evidence, particularly on the relationship between crop yield, fertility level and wild oat density.

Cultural Control

The value of research into this problem can be realized fully only if the findings can be applied to farm practice. Since there is little doubt on the principal reasons why wild oats become a pest in the field (early seed-shedding and dormancy), it is desirable to examine field practice as it affects the opportunity for seed distribution, breaking dormancy, control of seedlings and prevention of seed shedding. It is most convenient to examine the literature on this in the following order : introduction and spread of the weed, cultural (including husbandry) practices, crop sequences. In the first instance, remarks are confined to *A. fatua.*

Introduction and spread

Most authors agree that the primary means of introducing the weed to clean land is through using contaminated seed corn. In so far as it is only as seed that the weed can spread, so any means of introducing the seeds can provide an initial infection. In addition to impure seed, Thurston (1954b) lists several other authenticated means of spread : in sacks or bags used for a variety of farm purposes ; in straw used as packing material, litter or fodder ; transfer to clean fields by passing implements ; from the stacking of infested crops on clean land, and, possibly also, by means of farmyard manure. Thurston appears to doubt whether passage through an animal is of much consequence as a means of spread. On the other hand, Gram (1956) reports Danish legislation which requires that all infested feed grain for sale must be finely ground, which suggests that greater importance is attached to the possibility of passage of viable seeds through an animal than is the case in the UK. Somewhat similar legislation is in operation in Sweden (Nilsson-Leissner, 1956). The last two authors also report other legislative measures used to combat the wild oat. There is no legislation controlling wild oats in the UK and the species are not scheduled as ' injurious' or ' noxious ' weeds.

While wheat seed may be cleaned on a cylinder and barley on a separator, oats cannot be separated from wild oats economically at present. There is one reference to a method of doing this (Maljcev, 1941) by means of pouring the mixture of oats and wild oats between rollers, one of which is of lead, the other of zinc : the seeds of *A. fatua* " are not thrown as far as those of the smoother oats."

The importance of the combine harvester as a cause of increased incidence of wild oats is stressed by some although the published evidence on this point is not strong. That an appreciable number of wild oat seeds are passed through a combine and back onto the stubble has been shown by Golicyn and Levina (1940). In one study, the mean number of seeds shed before harvest was 53%, 24% were knocked direct to the ground as a result of the combine harvesting procedure, 7% found their way into the grain tank and 8% passed through the machine with the straw and cavings : the amount held up in the machine was not stated.

Field experience has also led Dadd (1957) to blame the combine harvester for some of the current troubles with wild oats. It is indisputable that the delay of 10 days or so between " binder-" and " combine-" ripeness will allow an increased number of seeds to shed. Furthermore, wild oat seeds readily lodge inside the harvester and this implement can be a potent means of spreading the weed from field to field unless exceptional and unpopular measures are taken to clean it between times.

Cultural and husbandry practices

References under this heading are divided between those which deal with means to encourage germination of the dormant seeds and those which refer to means of killing seedlings. Clearly the former is the more difficult.

Breaking seed dormancy may reasonably be said to be one of the keys to the control of this weed. Fire, chemicals and time have been discussed. Only time seems certain, but inadequate as a means to the farmer. Dormancy-breaking by chemicals has been discussed but has not yet figured in the literature.

There are several references to the apparent effects of stubble-burning. Thurston (1950b) points out that few seeds are killed by the heat but agrees with Dadd (1957) that the seed coat is often damaged with the result that dormancy appears to be broken. Eichfeld (1944) on the other hand maintains that stubble-burning kills many of the wild oat seeds lying on the ground. Hervey (1949) refers to a reduction in the incidence of wild oats in " annual plant ranges" in California following burning, although certain other species were increased. Hopkins (1936) showed that wild oats resisted heat more than any other seeds he tested, and that 15 min. at 105°C. was needed in order to kill them.

Autumn cultivation to encourage germination is generally recommended, with emphasis on the need for this to be shallow (Brown, 1953; Schaeffler, 1950 ; Smirnov, 1945). Shallow ploughing is generally specified with the explanation that the seed needs to be lightly covered with soil so as to encourage germination. Work in Canada (Saskatchewan, Dominion Experimental Farm, 1949) leads to the recommendation that the preparation of stubble for a wheat seedbed is best done with surface cultivation rather than with ploughing because less wild oats will infest the wheat crop. This agrees with similar field reports in England, known to the author of this review, although it is in direct contradiction to advice given by Robins, Crafts and Rayner (1953).

Some authors refer to the benefits of alternate shallow and deep ploughing. (Schaeffler, 1950 ; *Tidsskrift for Planteavl*, 1950). It may be that this recommendation is an endeavour to overcome the problem of seeds which are buried relatively deeply. It seems likely that the more deeply wild oat seeds are buried, the more lengthy the dormant period (Thurston, 1956). If this is the case the whole depth of soil in which there are wild oat seeds needs to be cultivated during any period of years of special treatment for the control of the weed.

While autumn cleaning is recommended for countries which have a long enough growing season—Canada and Sweden do not recommend the practice usually—most agree on the value of spring cultivation at the time of natural germination of *A. fatua*. As an example, Brown (1953) gives the following results of trials in Manitoba which show the reduction in wild oats infesting barley sown at different dates :

barley sown 8.5.52 contained 28·5 wild oat plants per sq. yd.

barley sown 11.6.52 contained 4·4 wild oat plants per sq. yd.

Most authors agree that there may be a reduction in yield as a result of delayed sowing of the crop, but even so this may be worthwhile. A few authors (e.g. *Tidsskrift for Planteavl*, 1950) recommend that spring-sown cereals should not be grown at all on land badly infested. While horse- or tractor-hoeing of cereals is practised to a limited extent in England (Dadd, 1957), the post-sowing treatment of cereals in Canada with a rod or wire weeder is finding some favour. Brown (1953) recommends this treatment just before emergence of the cereal. In one study in Canada, this operation reduced the wild oats from 15·7 plants per sq. yd. to 10·2.

Full fallowing is favoured in some areas but not in others. This may be a reflection of the natural germination periods of *A. fatua* under different climatic conditions. Smirnov (1945) in Russia and an anonymous writer in Denmark (*Tidsskrift for Planteavl*, 1950) recommend fallowing, the former with " correct agricultural technique " and the latter with alternate shallow and deep ploughing. One may assume that the right type of fallow is a fine one with early initial spring ploughing. English writers do not favour full fallowing since natural germination tends to fall off during the summer whatever the seedbed. It would seem that Brown (1952) sums up the situation reasonably well by saying that full fallowing may be a help in reducing the number of viable seeds in the soil at the cost of a year's cropping, but that it cannot achieve a complete eradication. An Ontario report (Ottawa, Central Experimental Farm, 1950) adds that fallowing may be disappointing in particularly dry summers. That fallowing, of itself, without suitable cropping subsequently may be a waste of time is shown by the results of further Canadian trials at Tisdale, Saskatchewan (Ottawa, Central Experimental Farm, 1950). This is in complete agreement with the view of Ellis (1750) 200 years ago, who recommended following a fallow with turnips.

The type and depth of cultivation to be given at any time will be influenced by the depth at which wild oat seeds will most readily germinate. Thurston (1951b) has shown that seeds will germinate (and produce seedlings) at depths of 9 in. but this is not likely to constitute a serious threat in the field.

Work at Ottawa (Canada Department of Agriculture, 1950) on the % emergence from seeds at varying depth is shown in Table 1.

TABLE 1

Effect of depth of seed on emergence

	% emergence							
Depth of seed (in.):	0	0·5	1	1·5	2	3	5	7
In autumn	1	5	14	17	16	15	21	2
In spring	0	3	12	13	29	25	27	17

Even after making allowance for different climatic and soil conditions these figures indicate the problem which faces the cultivator or the herbicide research worker where considerable

proportions of seeds buried at 5 in. or even 7 in. can produce plants. Added to this is the complication that the seedlings from deeply buried seeds will normally emerge later than those buried shallowly.

A husbandry practice which is frequently referred to (Schaeffler, 1950 ; Brown 1952 ; Dadd, 1957 ; Saskatchewan, Dominion Experimental Station, 1949) is the provision of conditions which will lead to the smothering of wild oat seedlings by crop competition. This is generally referred to in connexion with autumn cereals, but smothering crops such as rape, mustard, kale and silage mixtures are also mentioned. The Canadian report states that of the spring cereals, oats provide the best smother, then barley, then wheat. Thurston (1956) agrees that barley provides a better smother than wheat on the basis of pot experiments. Godel (1938) has shown the extent to which wild oats are reduced (92% by weight) in a cereal crop by improving crop growth solely with fertilizer and heavy seeding. He also stresses, as do others, that the wild oat seedling is particularly vulnerable to competition and other adverse factors when in the early stages of growth. Brown (1953) adds that the seedlings are most vulnerable to cultivation control when in the 2-leaf stage.

Crop sequences

Since, at present, the reduction of wild oats needs to be carried out principally by cultural means, the choice of crop and crop sequence is largely determined by the opportunities it gives the farmer to operate successfully against the weed. In addition, some crops compete more successfully than others. In essence, a sequence of crops suitable for the control of wild oats must provide opportunity for the virtual elimination of seed shedding over such a period of years that dormant seeds in the soil will either have germinated (and been killed) or have died without germinating.

An experiment in Canada (Manitoba, Dominion Experimental Farm, Brandon, 1954) compares the effects of two rotations, of 4 and of 6 years' duration, practised on adjacent fields for 30 years.

TABLE 2

Effect of crop rotation on wild oat control

Rotation	Percentage, by weight, of wild oats in threshed grain, average 1950–2 inclusive %
Four year :	
Fallow	—
Wheat	2·5
Wheat	4·3
Oats	6·1
Six year :	
Fallow	—
Wheat	Trace
Hay	—
Hay and wheat	—
Wheat	none—trace
Oats	Trace—0·4

Further Canadian work on the same lines has also been reported (Ottawa, Central Experimental Farm, 1950). Turning to Europe, the principles for a suitable rotation remain the same, but the type of farming allows the introduction of other crops. Aslander (1944) reports that in Sweden the following rotation is recommended :—bare fallow or green fodder/autumn wheat/row (hoed) crop/spring cereal/ley/ley. An alternative is : fallow or green fodder/winter barley/winter rape/winter wheat/roots/spring cereal/ley/ley/winter wheat.

In relation to the extent of the problem, there are relatively few European reports of the effects of various long- and short-term rotation experiments. In view of this it is worth quoting in Table 3 the results of a study in Denmark (Gram, 1956).

TABLE 3

Effects of rotation on the population of wild oats (average of six field experiments)

	Crop					No. of wild oat plants/m.²	
	1947	1948	1949	1950	1951	1947	1951
No rotation and no weeding	barley	barley	barley	barley	barley	105	211
No rotation but annual weeding	,,	,,	,,	,,	,,	105	21
Rotation	barley	barley	lucerne	lucerne	barley	109	39
Rotation	barley	beet	beet	beet	barley	112	9
Rotation	barley	beet	barley	beet	barley	113	73

Looking into the past, one finds (Young 1807) that in Essex wheat after peas was favoured as providing some check to wild oats. One may assume that the peas were long-strawed and a good smother and that the wheat was sown early after shallow ploughing ; coming after peas it was also likely to be a fairly strong crop. On the other hand, the same report indicates that the sequence fallow/wheat/fallow/barley did not check wild oats.

It appears that current work on the effect of individual crops and crop sequences on wild oats in Britain is somewhat limited in relation to the scale of the problem. Reference to current work at Rothamsted is made by Thurston (1954a, 1955, 1956) who refers to data that are being obtained and which will be available in due course. The Rothamsted Reports for 1954 and 1955 refer to a long-term experiment at Boxworth Experimental Husbandry Farm, near Cambridge, where the survival of wild oat seeds under a grazed ley is being studied. Another experiment is being carried out on a commercial farm.

The control measures discussed so far have been in respect of *A. fatua*. The areas infested with *A. ludoviciana* appear to be considerably less and one therefore finds relatively few references to control measures especially designed for this species. In view of the winter germination of the species it is not surprising that measures designed for *A. fatua* will in general control also *A. ludoviciana*. That it is a species especially suited to areas where winter sowing is regularly practised (and therefore generally on heavy soils) is illustrated by the fact that it is the principal species on Broadbalk, whereas *A. fatua* infests Hoosfield, at Rothamsted (Thurston, 1954a), the former almost continuous winter-sown wheat for over 100 years, the latter spring-sown barley for almost as long.

Chemical Control

It is the intention here to review the general lines only along which the search for a selective chemical control of wild oats has been proceeding. This has involved the testing of maleic hydrazide (MH), iso-propyl-n-phenyl carbamate (propham), CIPC, trichloracetic acid (TCA), and, more recently, of 2 chloroallyl diethyldithiocarbamate (CDEC) and 1 chloro-N-N-diallyl acetamide (CDAA). Other materials have also been tested, these include endothal, CMU and dalapon (Andersen and Helgesen, 1954). Work with dalapon continues.

MH was tested by Warren and Bronson (1952) as a pre-emergence herbicide at 2 and 4 lb./ac. Knowles (1953) tested MH as a pre-heading (shot-blade stage) application at 1 lb./ac., the cereal having already headed. Almost complete sterility of the wild oats followed, with minor or only moderate sterility in the cereal. This technique showed promise in spite of the practical difficulty of applying the material, but has been dropped primarily because the relationship in time of heading of the crop and weed is not sufficiently regular. This has also been discussed by Thurston (1956). Other materials appeared more promising for pre-emergence application and no recent developments with MH have been reported.

Work with propham, CIPC and TCA has been reported from many sources. Interest in CIPC has dwindled since the weed and crop response to it appears to vary with soil type more than is the case with propham (Wiese and Dunham, 1954) : Nelson (1952) also reports that CIPC was more toxic to sugar-beet than propham. The use of propham in peas and sugar-beet has shown promise, particularly as certain other troublesome weeds are also controlled (Gt. Britain, Norfolk Agricultural Station, 1955). In Sweden, propham is recommended, combined with intensive mechanical treatment (Åberg, 1957) : even so the main emphasis lies with cultural methods. Propham has also shown some variability in performance in trials at different sites (Spencer, 1954 ; Gregory *et al.*, 1954) with the result that in Britain at present the chief interest lies in TCA for use in beet and in peas and also in kale. Pfeiffer (1957) reported that TCA was safe and efficient for general use on sugar-beet at 7–8 lb./ ac. worked thoroughly into the seed-bed 10–14 days before sowing ; on peas there was evidence of some crop damage at some sites with consequent risk if the technique was widely recommended.

With the use of TCA commercially in 1957 in Britain on sugar-beet, and at farmer's risk on peas, a start will be made in putting a selective herbicide in the farmer's hands for wild oat control. Until a safe and reasonably efficient technique is developed for use in cereals the main problem will remain. Blackett (1957) reported some preliminary field studies using CDAA and CDEC, which are sufficiently encouraging to stimulate further work.

In most of the current work it is essential to obtain a very thorough and relatively early incorporation of the herbicide into the layer of soil in which the majority of wild oat seeds lie—that is those seeds which are likely to produce a seedling. This distribution in the top 4–5 in. of soil is necessary in order to ensure that the low rates of herbicides used are present in the vicinity of the seedling immediately after germination when it is at its most susceptible stage. None of the herbicide formulations so far tested is selective enough to permit safe and/or efficient control when applied post emergence.

Discussion

In spite of the increased attention being paid to wild oat research and to control of the weed in the field, there is no evidence yet that the problem

is becoming less acute. It seems that further consideration of some points could be justified. On the part of farmers and seedsmen, still more insistence should be placed on the need for cereal seed entirely free from wild oats. This must be the first consideration in any programme of control, and there should be no material hindrance to the achievement of this object with the field certification schemes and modern seed-cleaning resources now available. It is still not possible economically to clean mechanically a sample of oats containing wild oats and reliance will have to be placed on seed crop inspection.

Secondly, many farmers still do not appreciate, or at any rate practise, the cultural methods of control already proven as worthwhile, such as late-spring sowing, early-autumn sowing of cereals, specially designed cultivations and sequences of cleaning crops.

It is unlikely that many farmers will find time to clean out their combine harvesters thoroughly when the harvesting of an infested field is completed and before going into a clean field. The circumstantial evidence of the importance of this procedure is strong but the published critical evidence very slight. Possibly the combine manufacturers could make the job easier if the need were brought to their notice.

Chemical control investigations have so far been concerned mainly with the use of herbicides to kill the young wild oat seedling. The use of MH to produce sterility was an exception. There has been discussion on, but no report so far of attempts at, destroying dormancy, or rendering sterile or killing chemically, wild oat seeds lying on a cereal stubble. In many seasons there is often an opportunity to take some such action. Studies on abscission might show a means of preventing seed shedding, thus giving opportunity for the harvest of the wild oat seeds with the cereal.

A fairly common observation from farmers is that only certain parts of some fields consistently grow wild oats. Persistence or establishment of the weed under similar cropping and climatic conditions will vary. That this is no new observation is perhaps indicated by Young's (1807) reference to the occurrence of wild oats in " two or three acres in a field of eight or ten . . . . " Presumably it can only be some soil factor which is influencing this reported happening. Research cannot at present indicate the likely reason for it and some detailed investigation may be worthwhile.

One of the problems facing the farmer and adviser is the extent to which one can afford to live with wild oats. Clearly, eradication by cultural means, if possible, is difficult, expensive and will take several years. While heavy infestation of cereals must reduce yield by competition, there is as yet insufficient data to indicate the relationship between density of wild oats and cereal yield at various levels of fertility. Further information is needed since many farmers who may have to face continuing existence with wild oats would like to know the level at which they become of insignificant effect, assuming always that it is practicable to maintain the weed at or below that density.

Just so long as economics encourage extensive cereal farming, so long will the eradication of wild oats remain a problem. It is, therefore, in selective chemical control of wild oats in cereals that our main hope lies. Fundamental research and the detailed study of any unexplained field behaviour may reveal some chink in the wild oat's armoury which the biologist or chemist can exploit.

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FIELD CROPS

CEREALS

WHEAT

1 McCULLOCH, R. N. **The agricultural year at Roseworthy College.** *J. Dep. Agric. S. Aust.* 1956, **59**, No. 6, 229–36 and 243 ; No. 7, 277–80 and 289, illus. [Roseworthy Agric. Coll.]

In a rate of seeding trial, wheat yielded 27, 31, 34, 37 and 38 bu. per ac., when seeding rates of 36, 57, 72, 88 and 112 lb. per ac., respectively, were used. Sowing wheat and peas together at up to a rate of 90 lb. per ac. increased the total seed yield obtained, but pea yields were always obtained at the expense of the wheat yields. Different seasons tended to favour either wheat or peas. In wheat variety trials, Scimitar 48 and Gabo were the top-yielding very-early varieties ; Brolga led the early varieties in yield; RAC 20 (a local hybrid) and Sabre were the best of the mid-season varieties.—M.P.

2 LAUDE, H. H. and others. **Growing wheat in Kansas.** *Bull. 370. Kansas agric. Exp. Sta.* 1955, pp. 36, illus. [Dep. Agron., Kansas Agric. Exp. Sta., Manhattan]

3 MACINDOE, S. L. **Wheat-farming developments in Australia.** *World Crops* 1956, **8**, No. 11, 428–33, bibl. 7, illus.

The parts played by : changing methods of cultivation ; recent progress in mechanization ; the inclusion of legumes and improved pasture phases in the rotation; weed eradication measures and the use of improved wheat varieties in the Australian wheat industry are discussed.—M.P.

4 HOLMES, J. C. and TAHIR, W. M. **The effect of some factors on growth, development and yield of winter wheat.** *J. agric. Sci.* 1956, **48**, No. 1, 115–23, bibl. 32. [Edinburgh Univ.]

In an attempt to find factors which would increase the yields of low-density stands, seeds of Squareheads Master 13/4 were sown in rows 6 in. apart at within-row spacings of 2, 4 or 6 in., resulting in stands of 281,000, 155,000 and 104,000 plants per acre, respectively. Further treatments were 1, 2 or 3 cwt. of sulphate of ammonia applied on 6 March, 9 April, or 11 June, with and without hand-weeding. The various combinations of all these factors gave a total of 54 different treatments. Extensive data on their effects on growth, development and yield of the plants were recorded. Increase of N fertilization up to 2 cwt. of sulphate of ammonia per acre increased the grain yield of all populations following an increase in the number of tillers per plant. Time of N application affected the growth and development of the plants but not the grain yield. The late application produced a lower straw yield and a higher N content in the grain. Weed control increased the grain yield especially of the thin stand and by this method the yield was raised by 4, 1 and 2 cwt. per acre for the low-, medium- and high-density populations, respectively.—G.M.W.

5 TONIOLO, L. Studio sull'accestimento di cultivar di frumento e fattori che lo influenzano. [**A study on tillering of wheat cultivars and on factors which influence it.**] *Ann. Sper. agr.* 1956, **10**, No. 2, 669–709, bibl. 41, illus., English summary. [Ist. Agron. Gen., Univ. Padova, Italy]

The object of this investigation was to study tillering in relation to variety, sowing date and manuring, and also the survival of the principal and secondary stems, and yields. The 2-years' trials were carried out with plants of the wheat varieties S. Pastore, Aquila, Damiano, Tevere and Mara, which were grown in 60 vegetation tanks. Results showed that tillering was much greater in 1952–3, when the January/February temperatures were very low, than in 1953–4 when temperatures were higher. The order in which the varieties were placed with regard to amount of tillering varied in the 2 years but S. Pastore always had the greatest amount of tillering and Mara the lowest. The normal sowing dates were 28–29 Oct. in 1952–3 and 30–31 Oct. in 1953–4, and the late sowing dates were 14–15 Nov. and 16–17 Nov., respectively. In the first year there was a greater amount of tillering with the normal date but in the second year there were no significant differences. Manuring increased tillering considerably in both years but the greatest effects corresponded with different types of manuring in the 2 years. The mortality of the principal stems was lower, and that of the secondary stems was higher, in the first than in the second year. The density of secondary stems per sq. m. was, however, greater in the first than in the second year. It was confirmed that excessive tillering results in shoots which remain green or do not form ripe ears. —E.B.O.

6 VENKATARAMAN, S. **Water requirement of irrigated wheat—variety Kenphad.** *Curr. Sci.* 1956, **25**, No. 6, 179–80, bibl. 1. [Cent. Agric. Met. Observatory, Poona, India]

The results are given of field experiments in 1954–5, using tanks, to determine the water re-

quirement of wheat under irrigated conditions. The wheat was sown on 13 Nov. 1954 and harvested on 19 March 1955. Water consumption during the 2nd to 4th week of growth was 1·7 in., from the 5th to 7th weeks, 2·8 in., from the 8th to 10th weeks, 3·54 in., and from the 11th week to harvest, 6·8 in. The total water use was 14·5 in. —P.J.B.

7 VAN DOBBEN, W. H. De Wintertarweopbrengsten in 1954 en de weersomstandigheden. **The yield of winter wheat in 1954, and the weather conditions.** *Jaarb. CoCoBro.* 1955, **5**, 17–22, bibl. 5, English summary. [Cent. Inst. Landb. Onderz., Wageningen]

In 1954 the yields of winter wheat on experimental fields were higher than normal, whereas the straw yields were normal. The grain-straw ratio was high and this was the result of a very high number of grains/ha., as high as in the top-year 1949. The period of flowering and shortly afterwards appears to be critical for this feature. High temperature and heavy rainfall reduced the grain number. In 1954 the critical period was rather cool and dry, as in 1949. The 1000-grain weight was favoured by the cool weather, but the heavy rainfall in the rest of the summer prevented the grain weight from reaching a level above normal.—From author's summary.

8 HEWES, L. and SCHMIEDING, A. C. **Risk in the central great plains. Geographical patterns of wheat failure in Nebraska, 1931-1952.** *Geogr. Rev.* 1956, **46**, No. 3, 375–87, illus. [Univ. Neb., Lincoln]

9 ÅBERG, E. Rätt sort och riktig såtid. [**The right variety and the right sowing time.**] *Lantm. Svenskt Land* 1956, **40**, No. 32, 711–13. [Agric. Coll., Sweden]

The author gives advice on autumn-sown wheat and rye varieties suitable for the different regions of Sweden, as well as on sowing technique.—G.M.R.

10 FAJERSSON, F. **Weibull's Atson spring wheat, a new variety for Great Britain.** *Agri. hort. genet.* 1955, **13**, No. 3–4, 198–206, bibl. 7.

The new spring-wheat variety, Weibull's Atson, which was put on the British market in 1954, has been extensively tested in Sweden. The data regarding grain yield, stiffness of straw, earliness, resistance to diseases (races occurring in Sweden) and quality are given in this paper. The new variety is compared with Weibull's Atle wheat which is grown widely in Gt. Britain, Weibull's Kärn II, which is the official Swedish standard variety, and Weibull's Pondus, which has shown the highest yielding capacity of all spring-wheat varieties tried in Sweden.—Author's summary.

11 MARJANEN, H. Kevätvehnälajikkeiden satoisuus paikalliskokeissa koetuloksia vuosilta 1938–39 ja 1941–54. **Productivity of spring wheat varieties in local experiments [in Finland]. Results of trials from the years 1938-39 and 1941-54.** *Valt. Maatalousk. Julk.* No. 145, 1955, pp. 89, bibl. 59, illus., English summary.

12 STATENS FORSØGSVIRKSOMHED I PLANTEKULTUR, DENMARK. Forsøg med hvedesorter 1952–55. [**Trial of wheat varieties, 1952-5.**] *Medd. 550. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Dansk Frøavl* 1956, **39**, No. 16, 217–18.

Eleven wheat varieties, including 3 French and 1 Belgian, were tested in trials at 10 Danish stations, but only 3, namely, Weibull's Eroica, Hunsballe R and Nord Desprez, were included in all the trials. Weibull's Eroica was taken as the standard variety. In addition to short descriptions of each variety, tabulated information is given on straw length, grain-weight and -volume, percentage crude-protein content in the dry matter, grain- and straw-yield both absolute and relative, winter-hardiness and tendency to lodge and date of maturity.—G.M.R.

13 GENETICA AGRARIA. Le varietà di grano in diffusione e in prova dell'Istituto di Allevamento Vegetale di Bologna. [**The wheat varieties distributed by, and under trial at, the Institute of Plant Breeding of Bologna.**] *Genet. agr.* 1955, **5**, No. 3–4, pp. 16, illus.

14 DE BENI, U. Brevi note sulla nuova varietà di grano Produttore (S.6.). [**Brief notes on the new wheat variety Produttore (S.6.).**] *Sementi elette* 1955, **1**, No. 1, 26–9, illus. [Soc. Prod. Sementi, Bologna, Italy]

15 TRENTIN, A. Leone e Leonardo nuovi grani dell'Istituto di Lonigo. [**Leone and Leonardo, new wheat varieties of the Institute of Lonigo.**] *Sementi elette* 1955, **1**, No. 2, 50–4, illus. [Ist. Genet. e Sper. Agr. N. Strampelli, Lonigo, Italy]

16 CAVALAGLIO, F. Intorno alla valutazione delle caratteristiche ecologiche di alcune razze italiane di frumento. [**On the evaluation of the ecological characteristics of some Italian wheat varieties.**] *Ann. Fac. Agr., Perugia* 1954, **10**, 157–61, bibl. 4. [Ist. Ecol. Agr., Univ. Perugia, Italy] [Received Aug., 1956]

Azzi's concept of " velocity-mass-structure " is of assistance in studying the factors which determine wheat yields, velocity being expressed as the

number of days from earing to complete maturation, mass as the number of grams in the stem-ear at the time of maximum weight, and structure by an histological index which measures the tendency towards a macro- or a micro-cellular structure. Ten Italian wheat varieties were arranged in order of increasing values of velocity and decreasing values of the other 2 factors, Mentana being first with V_1 M_5 S_5 (low velocity, great mass and high structure) and Coccitta last with V_4 M_1 S_1. This order was maintained by these varieties with regard to yield in a year when climate, soil and other factors were favourable for wheat, Mentana yielding 3500 kg. and Coccitta 1700 kg. per ha. In an unfavourable year, the order was reversed, Coccitta being first with 1350 kg. and Mentana last with 600 kg. per ha.—E.B.O.

17 Azzi, G. La resistenza all'allettamento e la produttività. [**Resistance to lodging and the productivity (of wheat).**] *Ann. Fac. Agr., Perugia* 1954, **10,** 152–6. [Ist. Ecol. Agr., Univ. Perugia, Italy] [Received Aug., 1956]

A study was carried out with 7 wheat varieties showing different degrees of productivity and resistance to lodging. Data are given of their yields in 1947, a year unfavourable for wheat because of heavy rains which caused lodging and rust, and in 1953, which was favourable for wheat. The yields of the 4 most representative varieties in 1947 and 1953, respectively, were (kg. per ha.) : Mentana (high yielding and highly resistant) 1810 and 3510 ; Bjeloklasa osilesta (high yielding and susceptible) 1000 and 3130 ; Aka Komughi (low yielding and highly resistant) 1420 and 1600 ; Saissette (low yielding and susceptible) 640 and 1650.—E.B.O.

18 Pané, J. M. Un nuevo trigo que se difunde : el Pané 3. [**A new wheat which is spreading : Pané 3.**] *Agricultura, Madr.* 1956, **25,** No. 286, 83–5, illus.

A description is given of the winter wheat (*Triticum vulgare*) variety Pané 3 bred from Hybrid L-4 × Mentana. It is medium-early and its plants grow 95–100 cm. high. In comparative trials, Pané 3 yielded more than Pané 247 of the same parentage and already widely grown in Spain, and more than other varieties tested. The yields of Pané 3 ranged from 4193 to 5041 kg./ha.—E.B.O.

19 Cazal, L. and Grillot, G. Variétés de blé dur. [**Durum wheat varieties (in Morocco).**] *Terre maroc.* 1956, **30,** No. 320, 201–2.

20 Kelly, T. K. **Wheat variety trials at Hermitage Regional Experiment Station.** *Qd agric. J.* 1956, **82,** No. 4, 189–94, illus.

The results of 5 trials conducted since 1949 with 5 quick-maturing and 5 mid-season wheat varieties are tabulated. Spica and Seafoam were reliable quick-maturing varieties ; Puora was susceptible to rust ; Gabo was outstanding in 1949 and 1951. Of the mid-season varieties, Festival gave moderate yields but was promising, and appeared to be resistant to stem rust ; Celebration and Lawrence performed irregularly.—M.P.

21 Schlehuber, A. M. and Young, H. C. **Concho winter wheat.** *Bull. B-453. Okla. agric. Exp. Sta.* 1955, pp. 18, illus. [Agric. Exp. Sta., Oklahoma A. and M. Coll., Stillwater]

This medium-early wheat variety originated as a selection from a cross between Comanche and a pure-line selection of a cross between Hard Federation and Blackhull. It was tested from 1949–54, and, on average, outyielded Comanche by 16% and Pawnee and Triumph by 22%. It has good milling and baking characteristics. Tests have shown that it is resistant to most diseases, is moderately tolerant to yellow-streak mosaic, but is susceptible to stem rust.—G.M.W.

22 Myrick, D. C. **Economic studies of weed problems.** *Proc. 8th Calif. and 15th West. Weed Contr. Conf.* 1956, 45–7, illus. [Montana State Coll., Bozeman]

One to two shoots of *Cirsium arvense* per 16 sq. ft. will lower the yield of wheat sharply. The graph of degree of weed infestation against wheat yield shows a nearly straight line relationship with an infestation of 25 plants/16 sq. ft. causing a 50% yield reduction.—*Weed Abstr.* 5 : 1378.

23 Niemann, E. Fortschritte bei der Bekämpfung des Weizen- und Gerstenflugbrandes (*Ustilago tritici* [Pers.] Rostr. und *U. nuda* [Jens.] Rostr.) in den letzten Jahren. 1. Die Heiss- und Warmwasserbeizung. [**Progress during recent years in the control of loose smut on wheat and barley. 1. The hot- and warm-water treatments.**] *Z. Pflkrankh.* 1956, **63,** No. 7, 389–404, bibl. 42. [Biol. Bundesanst., Kiel-Kitzberg, W. Germany]

This is a review of literature from several countries over the past 15 years. The most effective method is (a) for wheat, to treat it for 2·5 hr. at 46°C. in a 0·01% mercurial disinfectant solution [kind not stated], and (b) for barley, to treat it for 2 hr. at 45°C. in a 0·1% mercurial disinfectant solution. The after-treatment consists of chilling in cold water and drying at 30–40°C.—D.B.

24 Pichler, F. Zur Frage der Warmwasserbehandlung des Saatgutes bei der Flugbrandbekämpfung. [**Hot-water treatment**

of seed for the control of loose smut.] *PflSchBer.* 1956, **17**, No. 1/2, 1–26, bibl. 24, illus. [Bundesanst. Pflanzenschutz, Wien, Austria]

During the soaking of cereal grains in water at 45°C. for 3 hr. for the control of loose smut [*Ustilago* spp.], the oxygen content of the water was reduced and anaerobic respiration set in. This process began earlier, was more intensive and lasted for a longer period in barley grain than in wheat grain. The reaction products of anaerobic respiration, viz., alcohol and acetaldehyde, could be detected in the grains at the end of the soaking period and during the subsequent drying process. This anaerobic respiration with its reaction products is the effective part of the hot-water treatment for destroying fungi on grain. The identification of these products could be used as a rapid laboratory technique for testing the effectiveness of a new method for controlling fungi.—D.B.

25 Holmes, N. D. and Farstad, C. W. **Effects of field exposure on immature stages of the wheat stem sawfly, *Cephus cinctus* Nort. (Hymenoptera : Cephidae).** *Canad. J. agric. Sci.* 1956, **36**, No. 3, 196–202, bibl. 6. [Fld Crop Insect Sect., Sci. Serv. Lab., Lethbridge, Alberta]

Experiments on the control of the wheat stem sawfly by exposure of the stubs in spring and autumn were carried out under field conditions. It was found that the time of exposure was important, and that in spring exposures the optimum period was late May and early June when the sawflies were in the prepupal and pupal stages. Earlier exposure led to reinstatement of diapause, and at later exposures adults emerged. Time of exposure did not have a differential effect when the stubs were exposed in autumn. Examination of stubs exposed from 14 August to 29 September in June of the following year showed 100% kills in nearly all cases.—G.M.W.

26 Wellington, P. S. **Studies on the germination of cereals. 2. Factors determining the germination behaviour of wheat grains during maturation.** *Ann. Bot., Lond.* 1956, **20**, No. 79, 481–500, bibl. 14, illus. [Off. Seed Test. Sta., Cambridge]

[See also *Fld Crop Abstr.* 9 : 689.] A comparative study has been made of the germination behaviour of a white-grained and a red-grained wheat variety throughout the course of maturation. Although freshly harvested wheat grains do not germinate during the early stages of ripening, the embryo will develop under germination conditions when it is completely exposed, or the epidermis of the pericarp only is removed. At the harvest-ripe stage the white grains germinate rapidly, but the emergence of the embryo is considerably delayed in the red grains. The varieta difference is due to the presence of the covering layers and becomes increasingly apparent in grains which have been prematurely harvested between 3 and 6 weeks after anthesis, and then subjected to desiccation. This effect of the covering layers on embryo development does not appear to be related to their permeability to water or oxygen. The behaviour of the two wheat varieties is thus determined by the mechanical properties of the covering layers, and especially the pericarp. These delay germination in the red grains until there has been an increase in the water absorbing power of the imbibed embryo.—Author's abstract.

27 Hanks, R. J. and Thorp, F. C. **Seedling emergence of wheat as related to soil moisture content, bulk density, oxygen diffusion rate, and crust strength.** *Proc. Soil Sci. Soc. Amer.* 1956, **20**, No. 3, 307–10, bibl. 10, illus. [Kansas Agric. Exp. Sta., Manhattan]

28 Hashimoto, Y. and others. **Physiological studies on ineffective tillers in rice, wheat and barley plants. 1. Effect of small tillers on the ripening of fruitful stems in wheat plants. 2. On the relation between weak and strong tillers at the stage of vegetative growth in wheat plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24**, No. 3, 166, English summary. [Shiga Agric. Coll., Japan]

Either cutting or bending over of weak tillers at the head-formation stage of growth increased ear weights, 1000-grain weights and the total weight of grain of wheat. At tillering, more P^{32} was transferred from the roots to weak than to strong tillers. At the stage of head formation, the same trend towards preferential transference of P^{32} to weak tillers was still evident, but was not marked. —From authors' summary.

29 Johansson, N.–O. and others. Undersökningar över höstvetets härdning och avhärdning. **Investigations on the hardening and dehardening processes of winter wheat.** *Sverig. Utsädesfören. Tidskr.* 1955, **65**, No. 1, 82–96, bibl. 12, illus., English summary.

During the winter of 1953–4, 4 winter-wheat varieties were studied. Cut plants were frozen in glass tubes using a new method, and, simultaneously, quantitative paper-chromatographical studies of the different sugars were made, together with an analysis of N. The following conclusions were reached. Wheat plants placed at low temperatures and in light increase their hardiness. The

ncrease is most rapid in the beginning, and after ome weeks a maximum hardiness is attained. When plants are placed in darkness the hardiness lecreases. At lower temperatures the hardiness at irst increases but soon decreases. The total-ugar content runs parallel to frost-hardiness. In ıardened plants sucrose is the dominant sugar, ınd the content of high polymeric sugars tends to ncrease in the later part of the hardening process. During the hardening process, water-insoluble ›rotein-nitrogen passes to some extent into water-oluble protein-nitrogen, and at dehardening the ›rocess is reversed. The protoplasmic viscosity in he leaf cells increases with increasing hardiness, ınd the protoplasm in hardened wheat plants is nore thermostable than in unhardened plants.—From authors' summary.

30 Tolbert, N. E. and Gailey, F. B. **Carbon dioxide fixation by etiolated plants after exposure to white light.** *Pl. Physiol.* 1955, **30,** No. 6, 491–9, bibl. 22, illus. [Oak Ridge Nat. Lab., Tennessee]

By means of experiments conducted on Thatcher vheat in the presence of labelled carbon dioxide t was possible to trace the various physiological ınd biochemical changes which take place during he greening process which follows the exposure f etiolated plants to white light.—D.B.

31 Kansas Agricultural Experiment Station. **Chemical composition of Kansas wheat.** *Tech. Bull. 79. Kansas agric. Exp. Sta.* 1955, pp. 46, bibl. 37. [Agric. Exp. Sta., Manhattan]

A literature review is given of variation in the hemical composition of wheat according to ariety and stage of growth and its dependence on limatic and soil factors. Protein and nitrogen, otal ash, mineral constituents and carotene are onsidered. Samples of wheat grain and young vheat plants of 3 varieties were obtained from 13 ocations in Kansas. A survey is given of the nethods used in analysis for N, P, K, Ca, Mg, Fe, Mn and Cu. Measurements were made of the vailable quantities of these elements in the soils nd of the total amounts in the plants. Also letermined were the fibre-, fat- and vitamin-ontents of the plants, and the pH, base-exchange apacities and mechanical composition of the soils. t was found that high mineral contents and high rotein contents of the grain were correlated and hat high K- and Mg-contents of the grain were orrelated, respectively, with high available K and Mg in the soils. The percent contents of minor lements showed more variation than those of ıajor elements. Applications of Ca, Mg and P ıcreased the mineral content but decreased the rotein content. In young wheat, a definite orrelation of carotene and of niacin content with protein was found ; low ash-content was correlated with low available quantities of soil nutrients. Graphs are given which show, for wheat, the changes in content of the following constituents with time : protein, carotene, total ash, K, Ca, P, Fe, Na, Mn and Cu, and the relations between protein and content of vitamins.—J.F.C.

32 Silvela, F. and others. Los trigos rojos bastos de Burgos. [**The coarse red wheats of Burgos.**] *Bol. Inst. Invest. agron., Madr.* 1955, **15,** No. 33, 327–34, bibl. 1, English and French summaries.

In order to study the milling and baking qualities of the soft red wheats grown in Burgos, Spain, 40 wheat samples from granaries in this area were analysed.—From authors' summary.

33 Pringle, Joyce and Williamson, W. T. H. **Some effects of a soil conditioner on a heavy and a light soil in Aberdeenshire.** *J. Sci. Fd Agric.* 1956, **7,** No. 8, 540–5, bibl. 9, illus. [Dep. Soil Sci., Univ. Aberdeen]

In pot experiments, a vinyl acetate-maleic anhydride polymer soil conditioner, CRD 186, was applied to samples of arable and ley soils at 0·05 g. per 100 g. of soil. In treated arable soil, germination of wheat seeds was 100% forty-eight hours after sowing, whereas in untreated soil, germination had scarcely begun and was only 30% two weeks later. Subsequent growth was also greater in the treated soil. The variety Jubilégem germinated sooner and grew more rapidly than Bersée. Untreated ley soil was inferior to the arable soil, but superior to the treated ley soil. These results were not confirmed in a field trial, which followed the pot experiments, because of adverse weather after sowing.—M.P.

34 Mackey, J. and Månsson, T. Resultat från kombinerade sort- och kvävegödslingsförsök i vårvete på Svalöf 1949-53. **Results of combined variety and nitrogen trials in spring wheat at Svalöf, 1949-53.** *Sverig. Utsädesfören. Tidskr.* 1955, **65,** No. 3, 182–96, bibl. 12, English summary.

The material comprised 10 varieties of spring wheat, some being bred strains, others local, not bred varieties. Calcium nitrate was applied as top dressing when the plants were 10–15 cm. in height, at the rates of 300 (normal) and 500 kg. (heavy) per ha., respectively. The heavy application was economic for all the varieties tested, even those of unbred origin, an average increase in grain yield of 9·5% being obtained. Nevertheless the ability of the different varieties to respond to the heavier rate varied, and weakness in this respect is attributed chiefly to lack of strength of straw. Among the stiff-strawed varieties there were indications that under Svalöf conditions it is

undesirable to have too little straw if maximum grain yield is to be obtained at high nutritional levels. Comparing the unbred and bred material, the increase in grain productivity due to plant breeding is estimated as 17–18%.—G.M.R.

35 Hoeser, K. Untersuchungen über den Einfluss steigender N-Gaben auf die Backeigenschaft des Weizens. [**The influence of increasing N applications on the baking quality of wheat.**] *Bayer. landw. Jahrb.* 1956, **33,** No. 1, 17–36, bibl. 25, illus. [Landessaatzuchtanstalt, Freising-Weihenstephan]

An increase in the protein content of wheat grain brought about by staggered, and therefore late, applications of N improves the baking quality only if the variety already has a genetically constituted good baking quality.—D.B.

36 Gadd, I. Fortsatta laboratoriförsök med betning och lagring av vårvete. **Continued laboratory experiments with dressing of wheat seed and its storing.** *Medd. 30. Frökontrollanst., Stockh.* 1955, 45–55, English summary.

Two classes of experiment were carried out : (1) dosage experiments using fresh hand-threshed seed, and (2) storage experiments with (a) mechanically injured seed and (b) common commercial wheat-samples, both under good and bad storage conditions and treated with different chemicals. Freshly harvested unripe seed of high moisture-content was unable to endure high doses of Panogen without injury, but, after drying, it endured five times the dose, provided that the seed-coat remained intact. Dry seed, treated and stored in a dry locality for several months, suffered no further damage, but if stored in a moist locality, strong overdosage caused a marked decrease in germinating capacity. Fully after-ripened wheat seed, treated with various chemicals and stored for longer than 1 year, kept its germinating capacity unchanged when stored in a cool, relatively dry place. Speed of deterioration was influenced by temperature. The new Swedish disinfectant Betoxin T.D. was shown to preserve seed for a long time because of its outstanding ability to prevent mould development. Panogen, to some extent, had a similar effect.—From author's summary.

37 Wye College, Department of Agricultural Economics. **Wheat production in south-east England.** *Rep. Dep. agric. Econ. Wye Coll.* 1956, pp. 24, illus.

This report deals with the economic aspects of wheat production in one farming area in south-east England and is based on results from 107 crops harvested in 1954.—From summary.

OATS

38 Pestalozzi, M. Vurdering av de klimatiske vilkar for havredyrking i Nordland fylke. Sortforsøk 1938–1954. [**Survey of the climatic conditions for oat-growing in the north of Norway. Varietal trials, 1938-54.**] *Forskn. Fors. Landbr.* 1956, **7,** No. 5–6, 417–39, bibl. 14. [State Exp. Sta. Vågønes, Norway]

From 1938–54, in 45 trials, 23 varieties of oats and 6 selected local strains were tested. Vågønes Experiment Station is situated 67°N. at an altitude of approximately 30m., near the sea, and the trials took place within the latitudes 65°–69°N., an area which constitutes the economic limit for the growing of oats. During these trials a study was made of the effect of temperature and rainfall upon the length of time taken for oats to reach the yellow-ripe stage from sowing. In agreement with the results of earlier Norwegian studies, the ripening of oats was found to be the more rapid, the higher the mean temperature and the less the mean daily rainfall during the growth period. Probably the distribution of warm and cold days during this period also affects the time taken by oats to mature, and the yellow-ripe stage was reached particularly rapidly in years having long periods of drought. For these reasons, the mean of the highest temperature recorded on the 55 warmest days and the duration of periods of drought were used as a measure of the temperature and rainfall conditions, and a statistical application of this measure to 16-years' trials of the variety Perle grown in sandy soil shows a correlation to exist between temperature and rainfall on the one hand and the length of time elapsing from sowing to yellow ripeness on the other. In the case of Perle a rise of 1°C. in the mean temperature for the months June to August resulted in 10·5 days earlier maturity, while an increase of 100 mm. in the amount of rainfall from May to July retarded ripening by 8 days. Formulae enable the number of days required by the varieties Perle, Nidar and Kytø to progress from sowing to yellow ripeness in localities for which meteorological records are available. In the Bodø region (67°N.) only the earliest varieties, Nidar and Nidar II, are suitable, and even these, on an average every tenth year must be harvested before fully ripe. In the Brønnøysund region (65·5°N.) somewhat later varieties such as Perle, Hein II and Voll can be grown without too much risk. North of Bødo and in the higher parts of the experimental area, climatic conditions render profitable oat-growing impossible. Of the varieties tested, Perle and Nidar I are taken as standard, while Voll, a new variety having good grain yield and strength of straw, is recommended for places with more favourable conditions.—G.M.R.

39† Pearson, F. B. and Judd, P. **Oat varieties for grazing, hay, grain.** *J. Dep. Agric. S. Aust.* 1956, **59,** No. 11, 425–9, and 447.

Oat varieties are recommended for 8 districts of South Australia. Descriptions of 12 established and 6 recent varieties are given. Early Kherson, Fulghum, Orient and Algerian are the most satisfactory oats grown in the State at present. Seeding rates used (in lb. per ac.) are : 15–20 for a cover crop ; 30–40 in lighter soils and lower rainfall districts ; 50–60 in heavier soils of the Central and Lower North districts ; 60–80 in the high rainfall areas of the Hills and South-East ; 80 lb. under irrigation.—M.P.

40 Statens Forsøgsvirksomhed i Plantekultur, Denmark. Forsøg med havresorter 1949–54. [**Oat varietal trials, 1949-54.**] *Medd. 529. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Tidsskr. Planteavl* 1955, **59**, No. 2, 353–7.

The performance of 8 Danish and Swedish varieties and 1 Finnish (Tammisto Sisu) oat variety in different soils is described, attention being given to grain and straw yield, grain/straw ratio, tendency to lodge, straw-length, grain-weight, date of maturity etc., and short notes on each variety are presented.—G.M.R.

41 Eikeland, H. J. Forsøk med havresorter 1950–54. **Trials with oat varieties 1950-54.** *Forskn. Fors. Landbr.* 1956, **7,** No. 4, 317–51, English summary. [Agric. Res. Bd, Norway]

Four Norwegian, five Swedish and one Finnish oat variety were tested at 7 experimental stations in Norway, and on the results of these trials each variety is appraised for its suitability for different districts of the country.—G.M.R.

42 Winkler, H. and others. Härkomstförsök med havre. [**Trials with oats from different sources.**] *K. LantbrAkad. Tidskr., Stockh.* 1955, **94,** No. 5–6, 339–59, bibl. 12, English summary. [Exp. Fm, Flahult, Sweden]

Charges that the oat variety Bambu deteriorates in yield and vigour when grown successively on the same farm have not been confirmed by 5-year trials made in the south of Sweden. The trials, 15 in all, took place on 3 farms at an altitude of approximately 600 ft. and compared the results obtained from original seed of Bambu and also of Guldregn II with those from first-, second-, and third-generation seed grown on the same farm. With the methods used, the difference in yield between the original and home-grown seed was insignificant, nor could any definite relations between soil and harvest be deduced. In some cases Mn was used by plants in quantities larger than were necessary for normal development, and, in the 1949 trials, the application of boron resulted in an increased content of B in the grain. The undeniable decrease in yield observed in farm practice is probably attributable in the main to unsatisfactory drying, cleaning, sieving and storage of the home-grown seed and also to the sowing of insufficient amounts of seed in relation to its germination power, viability, size and treatment. —G.M.R.

43 Persson, P. J. and Bingefors, S. Råprotein- och fetthalt hos vit- och svarthavre i försök vid Sveriges Utsädesförenings Ultunafilial. **Crude protein and fat content of white and black oats in trials at the Ultuna branch station of the Swedish Seed Association.** *Sverig. Utsädesfören. Tidskr.* 1956, **66,** No. 3, 174–81, bibl. 5, English summary.

Simultaneously with similar work done at Svalöf (see *Fld Crop Abstr.* 8 : 1205), studies were made of crude-protein and fat content in 4 varieties of white oats and 6 of black oats grown in Ultuna trials from 1918 to 1954, Seger being taken as the standard variety. The black-hulled variety Stormogul II had very good grain yield, but, together with Engelbrekt II and Klock II, it had a distinctly higher percentage of hull than the white-hulled varieties. Crude-protein content in Örn, Sol II, Roslags and Stormogul II was lower than in Seger. In Klock II it was remarkably high, in spite of a high percentage of hull. Protein content varied widely from year to year. It was on an average about 2% higher in the Ultuna than in the Svalöf material, but grain yield was lower at Ultuna. Annual variations in crude-fat content were smaller. In Seger, crude-fat content was on an average about 0·8% lower than at Svalöf. All the other varieties studied at Ultuna had a higher fat content than Seger.—G.M.R.

44 Wiklund, K. Niphavre (Å 01600) i försök inom mellersta, övre och inre Norrland. **Nip oats in trials in central, upper and inner Noorland.** *Sverig. Utsädesfören. Tidskr.* 1956, **66,** No. 3, 163–73, bibl. 5, English summary.

The new variety Nip is an early black oat derived from the cross (Guldregn I × Orion II) × Orion II, which, after the testing of 26 generations, became available to the farmer in 1955. It is well adapted to the usually acid soils of Noorland, and, in trials with other varieties, has given promising results.—G.M.R.

45 Hagberth, N. O. Pendekhavre. [**Pendek oats.**] *Weibulls ill. Årsb.* 1956, **51,** 28.

Pendek is an oat variety bred at Hoofdorp, Netherlands, from a cross between Flämingsgold

and Binder, and was put on the market in 1954. It has been tested by the Weibullsholm Plant Breeding Station for 2 years in about 30 trials. Compared with the variety Sol II, it ripened on an average 5 days earlier but it yielded 5–6% less. Its straw is extremely short, nearly 20 cm. shorter than that of Sol II. In strength of straw the variety is good. It has given good results in soil well provided with N.—G.M.R.

46 Waywell, C. G. **The effect of herbicidal treatments on oats.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 391–7, illus. [Ontario Agric. Coll., Guelph, Canada]

An experiment on oats, variety Beaver, is described in which 2,4-D (ester) at 4–12 oz. per acre, 2,4-D (amine) at 6–12 oz. per acre, MCPA (ester) at 4–12 oz. per acre, and MCPA (amine) at 6–12 oz. per acre were applied at 25 dates. Results show that 2,4-D depressed yields when compared with MCPA as did 2,4-D ester when compared with the amine. The most susceptible stage was from shortly after emergence to 3·5 weeks later. No effect on germination of the seed from treated plots was apparent.—*Weed Abstr.* 4 : 776.

47 Jacks, H. and Cruickshank, I. A. M. **Seed disinfection. 13. The effect of fungicidal seed treatments on emergence and covered-smut (*Ustilago kolleri* Wille) of oats.** *N.Z. J. Sci. Technol. Sect. A*, 1956, **38**, No. 1, 27–9, bibl. 4. [Dep. Sci. Industr. Res., Auckland]

Nine proprietary seed dressings were tested in two field trials to determine their effect on emergence and on control of covered smut of three varieties of oats. Granosan M significantly reduced emergence under wet soil conditions. Other seed treatments did not significantly affect emergence. Some organic mercury compounds were more effective than others in control of covered smut ; thus Granosan M, Panogen, and Verisan gave complete control, whilst Ceresan, Agrosan GN, and Agranin, and to a lesser extent Agrimax M and Leytosan, gave significant reduction of infection. Hexachlorobenzene as Anticarie SD, although reducing the incidence of covered smut as compared with checks, was not as effective as the mercury compounds. Under conditions favourable for smut infection, the variety Milford is more susceptible than the varieties Onward or Abundance.—Authors' summary.

48 Yoshida, M. **Results of varying the date of seeding and altering the spacing of stands on the growth of ears in spring oats.** [Japanese] *Proc. Crop. Sci. Soc. Japan* 1956, **24**, No. 3, 191–2, English summary. [Univ. Hokkaido, Japan]

The spring oat variety Kairyo-Hadaka was sown at rates of 0·8, 0·5, 0·2, and 0·08 bu. per ac. in rows 2 ft. apart and at 5 different dates from 27 April to 22 June, at 2-week intervals in 1953. Tiller numbers increased from 1 per plant at the highest sowing rate, to 15 at the lowest sowing rate, irrespective of sowing date. Leaf numbers and height of main culm were not affected by sowing date, but were related to sowing rate. Tillers bearing 3 leaves, only, did not produce ears. The duration of vegetative growth was about 7 weeks, irrespective of sowing date and thus day length and air temperature.—From author's summary.

49 Limarj, R. S. **[The effect produced on growth and development of oat plants at different stages of ontogenesis by increased temperature of the soil.]** [Russian] *Doklady Akad. Nauk, SSSR* (*Proc. Acad. Sci., USSR*) 1956, **108**, No. 6, 1194–6, bibl. 9, illus. [State Nat. Sci. Inst., im. P.F. Leshaft, Acad. Pedagogic Sci., RSFSR]

The effect of different soil temperatures on plants has been widely studied, usually from the aspect of the whole course of the plants' life. The author's study is concerned with the oat variety Golden Rain, grown in vessels to determine the effect of different soil temperatures on the plants during (1) the vernalization phase, (2) the light phase, and at (3) the critical period. The experiments were designed to warm the soil by means of an arrangement of electric lamps (1200 watts) under the culture vessels. The lamps were switched on at 9 a.m. and off at 9 p.m. The overground parts of the plants were at normal air temperatures. The data show that for variant (1) when the average temperature of the soil (from 16 April–25 June) was 22·5°C. (air temperature 16·5°) growth was accelerated, but development was retarded (3 days later than the control). In variant (2), when the average temperature of the soil was (26 June–5 July) 25·5° and (6 July–15 July) 27·8° (air temperatures 18·7° and 22·3°), development was accelerated (earing being 3 days earlier than the control) notably by shortening the critical period (duration 12 days compared with 16 days in the control). In variant (3), when the average temperature of the soil (16 July–27 July) was 22·6° and (28 July–3 August) 26·2° (air temperatures 16·3° and 23·4°), development was accelerated by advancing ripening 5 days earlier than the control. There is also evidence that treatment during (1) augments tillering activity. [See also *Herb. Abstr.* 11 : 1208].—M.H.

50 Mills, K. S. and Schrank, A. R. **Some effects of X-irradiation on the growth of *Avena* seedlings.** *Growth* 1956, **20**, No. 1, 29–36, bibl. 18. [Univ. Texas]

RYE

1 Statens Forsøgsvirksomhed i Plantekultur, Denmark. Forsøg med såmængder af rug 1946–52. [**Seeding-rate experiments with rye, 1946-52.**] *Medd. 516. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Tidsskr. Planteavl* 1955, **59,** No. 1, 151–4.

The results of trials at 5 places showed that seeding rate, given rye of good germination capacity, can vary within wide limits without having a significant effect upon yield of grain or straw. The best grain yield was obtained from sowing 180–220 kg. per ha. Any increase reduced grain yield, increased the proportion of straw and reduced grain weight, and there was little advantage, on the whole, in using more than 180 kg. seed per ha.—G.M.R.

2 Andersen, T. Artsforsøg med hvede og rug 1945–51. [**Trial of wheat and rye, 1945-51.**] *Beret. 505. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Tidsskr. Planteavl* 1955, **59,** No. 2, 185–95.

A comparative study was made of the yield of wheat and rye grown separately in clay soil (5 localities), sandy soil (2 localities) and marshland (1 locality). The plots received calcium nitrate at two levels, namely 200–300 kg. and 400–500 kg. per ha. On an average, rye gave a higher grain yield than wheat in all the localities except the marshland, where the yield of wheat, both grain and straw, was very much greater than that of rye except in 1947, when the wheat was killed by frost. The wheat's strength of straw contributed to its success in marshland. Under severe winter conditions rye proved the more reliable crop.—G.M.R.

3 Finch, L. R. and Carr, D. J. **Nucleic acid content of Petkus rye embryos in relation to vernalization and devernalization.** *Aust. J. biol. Sci.* 1956, **9,** No. 3, 355–63, bibl. 14. [Univ. Melbourne]

BARLEY

4 Wilten, W. Phaeno-klimogram voor de zomergerst in het Zuidwestelijk kleigebied. [**A pheno-climogram for spring barley in the south-western clay district (of the Netherlands) in 1955.**] *Jaarb. NaCoBrouw.* 1956, 78–82, English summary.

On the basis of a description of the ideal spring-barley climate, the influence of the 1955 weather-conditions on yield and quality of the barley crop are described. During the whole growing-season, the green-leaf surface was smaller than in 1954. This was caused by the late sowing and the cold month of May. As " green-leaf surface during the growing period " had been correlated with yield, a yield lower than in 1954 was expected and verified. Low rainfall in the last 20 days of July was the cause of a low N-content in the kernels and perhaps the " normal " sunshine in July is closely correlated with the absence of dormancy.—From author's summary.

55 Wilten, W. and Coenradie, J. De veldproeven in 1955. **Field experiments with spring barley varieties in 1955.** *Jaarb. NaCoBrouw.* 1956, 83–93, English summary.

Results are given of variety- and nitrogen-trials with spring barley varieties in the South-western clay district of the Netherlands. The varieties Balder and Piroline, both common varieties in the district, were outyielded by other malting barley varieties such as Carlsberg, Firlbeck 10443, Proctor and the fodder-barley Vada (previously named P.B.26). [The relative yields of these 6 varieties were : 100, 104, 107, 105, 105, and 109, respectively.]—From authors' summary.

56 Kooi, I. and Nijdam, F. E. **Distinction by grain characters of the two-rowed summer barley varieties on the list of 1955.** *Euphytica* 1956, **5,** No. 2, 157–62, illus., Dutch summary. [Inst. Res. Vars Fld Crops, Wageningen] [Received May, 1956]

The varieties studied were Piroline, Mansholt's Two-rowed, Balder, Carlsberg, Herta, Kenia, Saxonia, Agio and Minerva. Some of these can be separated individually and the rest put into groups by reference to qualitative characters, i.e. hairiness of rachilla, occurrence of spicules in the lateral lemma-nerves, red pigment in the lemma-nerves and fine hairs on the palea along the ventral crease. Within the groups, distinction is possible by quantitative differences in these and other characters.—J.F.G.

57 Edinburgh and East of Scotland College of Agriculture. Field Experiments Committee. **A report on three years' experimentation with barley varieties, 1953 to 1955.** *Tech. Bull. 15. Edinb. E. Scot. Coll. Agric.* 1956, pp. 12.

In the trials, yield, maturity, straw-strength, straw-length, malting and brewing qualities of the varieties Ymer, Herta, Rika, Carlsberg, Drost and Proctor were compared. Varietal notes are given with reference to conditions in the south and east of Scotland. Ymer and Drost were outstanding at Boghall and in the northern region, and Ymer was best in the southern region, in respect of yield. Drost and Carlsberg were, on average, the best malting varieties.—M.P.

58 KÅHRE, L. Mekaniska skador på kärnorna nid skördetröskning av sexradskorn och vårvete. **Mechanical damages on kernels in direct combining of six-rowed barley and spring wheat.** *Medd. 31. Frökontrollanst., Stockh.* 1956, 27–37, illus., English summary.

59 KÅHRE, L. Skördemetodikens inverkan på utsäde av sexradskorn. Preliminär rapport. **The influence of harvesting methods on seed quality of six-rowed barley. Preliminary report.** *Medd. 30. Frökontrollanst., Stockh.* 1955, 33–44, illus., English summary.

Studies were made of the influence of varying drum speeds in threshing on the grain quality of barley and wheat at harvest and during storage. High speeds caused severe damage and reduced the germination capacity of the barley varieties Edda II and Åsa (not Presto) and of Drott spring-wheat. Undried grain of Edda II and Åsa (not Presto) showed a marked depression in vitality after 3 months' storage and this was increased by high drum speeds.—From author's summary.

60 ANDERSEN, S. Skadevirkning på korn ved sprøjtning med 2,4-D og 4K–2M. [**Damage to cereals from spraying with 2,4-D and 4K-2M.**] *Tidsskr. Planteavl* 1955, **59,** No. 1, 132–50, bibl. 18, illus., English summary. [Roy. Vet. Agric. Coll., Copenhagen]

In 4-years' experiments, susceptibility to damage from spraying with growth-regulator preparations was studied in barley and oats as affected by : seeding rate and width between drills (seeding rate affected the development of the plants and the susceptible stage was reached late when seeding rate was low) ; fertilizers (those tried, namely, N, K, and Mn, were without effect) ; variety (varietal differences in susceptibility and development were found) ; time of day at which spraying is done (apparently of no great importance) ; night frosts (these, immediately before or after spraying, caused severe damage in some cases, but had no effect in others) ; sunshine, warmth and rainfall. Weather conditions seemed to be very important. Damage was considerable when there was cold, cloudy weather with rain before spraying and warm, sunny weather afterwards : with reversed conditions the damage was slight. On this point see also *Proc. Brit. Weed Control Conf. 1954–1955,* 2, 395–9. [*Fld Crop Abstr.* 8 : 1076].—G.M.R.

61 HANF, M. Die Wirkung wuchsstoffhaltiger Unkrautbekämpfungsmittel auf das Getreide unter besonderer Berücksichtigung von Anwendungszeit und Ernährungszustand. [**The effect of hormone containing herbicides on cereals with special reference to the time of application and nutritional state of the plant.**] *Mitt. biol. Bundesanst. fur Land- u. Forstwirtschaft* 1956, No. 85, 189–93, illus. [Landw. Versuchssta. Limburgerhof der Badische Anilin- und Sodafabrik, AG., Ludwigshafen, W. Germany]

Examples of the usual morphological abnormalities which occur from time to time in the inflorescence of barley and oats as a result of treating the crop with herbicides are described and illustrated. These abnormalities occur most frequently when the herbicide is applied within the first 30 days of sowing, i.e. at the 2nd to 3rd leaf stage.—D.B.

62 BAHTEEV, F. H. [**A fossil form of cultivated barley—*Hordeum lagunculiforme* Michi.**] [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci., USSR)* 1956, **110,** No. 1, 153–5, bibl. 18, illus.

[See also *Fld Crop Abstr.* 2 : 235, and 9 : 303.]

63† POSTEL, W. Der Einfluss genetischer und ökologischer Faktoren auf den Eiweisshaushalt von Sommergerstencaryopsen, unter besonderer Berücksichtigung der exogenen Aminosäuren. [**The effect of genetic and ecological factors on the protein economy of caryopsides of spring barley with special reference to the exogenous amino-acids.**] *Züchter* 1956, **26,** No. 7/8, 211–39, bibl. 14, illus. [Bundesanst. f. Qualitäts Forsch. Pfl. Erzeugnisse Geisenheim-Rheingau, W. Germany]

The term exogenous amino-acids refers to those which are essential for animal maintenance and growth : valin, leucin, isoleucin, threonin, arginin, histidin, lysin, phenylalanin, tryptophan and methionin. The ecological factors which increase total protein also increase the amount of exogenous amino-acids, some acids more than others ; hence, environment changes the quality as well as the quantity of the protein. Tabulated records are produced showing results obtained from trials with German barley varieties in 6 different parts of Germany and with the varieties Herta and Carlsberg in 6 different countries of Europe : Ireland, England, France, Switzerland, Austria and Finland. There are varietal differences in the exogenous amino-acid content of spring barley caryopsides, but these are slight compared with the differences brought about by environment.—D.B.

64† COLEMAN, R. G. and RICHARDS, F. J. **Physiological studies in plant nutrition. 18. Some aspects of nitrogen metabolism in barley and other plant**

in relation to potassium deficiency. *Ann. Bot., Lond.* 1956, **20**, No. 79, 393–409, bibl. 15, illus. [Imp. Coll. Sci. Technol., Lond.]

Barley was grown in water and sand culture using a variety of nutrient solutions, the most important variable being potassium supply. The diamine putrescine, which is not normally found in this plant in appreciable amounts, is present in the potassium-deficient seedling and accumulates during its growth. Maximum accumulation coincides with the development of the severe symptoms associated with advanced deficiency. Putrescine occurs at an earlier stage in potassium-deficient plants whose nitrate and phosphate are supplied as ammonium salts than in those to which the corresponding calcium salts are given. It is found less abundantly in the roots than in the tops. It is absent from protein hydrolysates. A leaf necrosis characteristic of potassium-deficiency is induced by feeding putrescine to barley having a high potassium status ; after prolonged feeding the appearance of such plants suggests severe potassium starvation. The putrescine is slowly utilized, and at the same time an unidentified substance is produced. What seems to be the same substance appears in quantity in high-potassium red clover during the course of rapid utilization of administered putrescine. It also occurs naturally in potassium-deficient red clover. When potassium is supplied to potassium-deficient barley in which putrescine has accumulated, the amine soon disappears. Application of either rubidium or sodium also leads to a reduction in putrescine, though to a lesser extent, rubidium being the more effective element. Under conditions of extreme potassium-deficiency wheat and red clover also accumulate putrescine. The free amino-acid composition of the wheat then bears a striking resemblance to that of deficient barley.—Authors' abstract.

65 Lerman, R. I. [**Variation in carbohydrate metabolism in the barley plant in relation to high soil moisture.**] [Russian] *Doklady Akad. Nauk, SSSR (Proc. Acad. Sci., USSR)* 1956, **108**, No. 6, 1191–3, bibl. 8. [State Nat. Sci. Inst., im. P.F. Leshaft, Acad. Pedagogic Sci., RSFSR]

The physiological peculiarities of plants grown in soils with a high moisture content have been studied very little. The author's earlier observations have shown that saturated soil affects plants in different ways, depending on their stage of development. For example, at the vernalization phase the number of spikelet initials is lessened ; at the light stage, flower differentiation is lessened and there are other symptoms of interrupted metabolism (e.g. leaf yellowing). The present work is concerned with carbohydrate metabolism in leaves and grain of plants (Viner barley) when grown with a soil moisture content 120% of the soil's full water-holding capacity. The observations were made at the vernalization phase, the light phase, at earing and at the stage of milk ripeness. The controls were grown with 70% of the soil's full water-holding capacity. The content in the leaves of glucose, saccharose, starch and hemi-celluloses was determined, in addition to glucose, saccharose and starch in the grain. There is evidence that the content of glucose in the leaves of the control plants increases sharply at the earing/flowering phase, i.e. at the time of the plants' greatest physiological activity. The greatest increase in saccharose and polysaccharides occurs at the end of the vegetative period, at the time of grain filling, and at milk ripeness. Under abundant moisture supply, the carbohydrate content of the plants is, in general, much less than that of the controls ; glucose and saccharose content, for example, being only half the amount found in the controls ; at the light stage, however, and at earing, there is some increase in the content of starch and hemicelluloses. The grain of the controls contains a greater quantity of carbohydrates than the grain of plants grown with high soil moisture. Starch in the grain is lowered especially in those plants grown with high soil moisture at the end of the vegetative period. The grain weight of plants grown with high soil moisture in all phases is lower than that of the controls and is especially low with abundant moisture in the vernalization phase (34·17 g./10 plants) and at grain ripening (35·35 g./10 plants) compared with the control (41·5 g./10 plants).—M.H.

66 Skazkin, F. D. and Rozkova, V. G. [**The effect of boron on cereal crops under a deficient supply of water during the critical period of their development.**] [Russian] *Doklady Akad. Nauk, SSSR (Proc. Acad. Sci., USSR)* 1956, **108**, No. 5, 962–4, bibl. 14, illus. [Herzen State Pedagogic Inst., Leningrad]

Although the effect of boron on crops has been studied in much detail, there is little information regarding the effect of boron when the crops' water supply is deficient. The present work is concerned with the influence of boron on barley plants (*Hordeum vulgare* var. Viner) at the critical phase of growth (i.e. tetrad formation of pollen-mother-cells/earing). Under the conditions of the experiments there is evidence that boron (applied to the soil in culture vessels, 10 plants per 5 kg. soil, before sowing ; and also during the plant's critical period, at 3 mg. B in the form of H_3BO_3/1 kg. soil ; and as a leaf spray, 0·1% solution H_3BO_3 5 days before tetrad formation) lessens in some degree the damage done to the plants under a deficiency of water (13% of full water-holding

capacity compared with 70% in control), grain yield being 3 to 4·5 times greater than that of the control without boron. This effect of B is attributed to its beneficial influence on the water regime of the plant and on carbohydrate metabolism.—M.H.

67 RAGAI, K. I. **An investigation of the water relations of barley cultivated under desert conditions in Egypt.** *Phyton* 1956, **6**, No. 1, 57–70.

With barley of 30-days growth, in soil of different moisture contents, the desert-adapted Mariuti type initially transpired more rapidly, but subsequently at a lower rate, than the Baladi type, acclimatised to irrigated conditions. The more extensive root development of the former type depleted soil moisture to lower levels before permanent wilting occurred. Transpiration rates were lower with 5% and 10% than with 15% and 20% soil-moisture levels but decreased again when the 25% level was reached because reduced aeration had then reduced root development.—M.H.F.

68 COENRADIE, J. and others. Enkele kwaliteitseigenschappen van "inundatiegerst". [**Quality of spring barley grown on inundated soils (in the Netherlands).**] *Jaarb. NaCoBrouw.* 1956, 58–62, bibl. 5, English summary.

Analyses were made of 154 samples of barley grown on soils which had been inundated with salt water. The protein content of the barley increased as the NaCl content of the soil increased. The cause of the phenomenon is ascribed to a higher N-supply to the plant.—From authors' summary.

MAIZE

69 YOUNG, E. F., Jr. and ORSENIGO, J. R. **Corn [maize] investigations in Venezuela in 1953 and 1954.** *Publ.* 7. *IBEC Res. Inst.* 1955, pp. 19, illus. [Received April, 1956]

70 JAKUŠKIN, I. V. [**Methods of increasing yields of maize.**] [Russian] *Izv. Timirjazevsk. seljsk. Akad.* (*Bull. Timirjazev agric. Acad.*) 1956, No. 1 (11), 15–24.

A review is given of the work carried out during 1954–6 in various regions of the USSR on experiments and cultural methods for producing good harvests of maize. The target for maize production in 1960 will require an area of 28 million hectares to be sown under this crop.—M.H.

71 HAYNES, J. L. and SAYRE, J. D. **Response of corn to within-row competition.** *Agron. J.* 1956, **48**, No. 8, 362–4, illus. [Ohio Agric. Exp. Sta., Wooster, Ohio]

With the development of the practice of inter-sowing maize, the effects of closer within-row spacings and wider between-row spacing were studied. During 1954–5, maize was grown at within-row spacings of 1, 2, 4, 8, 16, 32, 48 and 64 in. in rows 8·5 ft. apart. Maximum ear yield occurred at the closer spacings.—G.M.W.

72 LANG, A. L. and others. **Influence of population and nitrogen levels on yield and protein and oil contents of nine corn hybrids.** *Agron. J.* 1956, **48**, No. 7, 284–9, bibl. 22, illus. [Ill. Agric. Exp. Sta., Urbana, Illinois]

The 9 maize hybrids responded differently to variations in stand density and N content of the soil. High N levels increased yields at high populations. Protein- and oil-contents of the grain decreased with increase in plant population and decrease in N content.—G.M.W.

73† PITNER, J. B. and others. Aumento en la producción de maíz y trigo mediante abonos verdes. [**Increase in the yield of maize and wheat by means of green manures.**] *Foll. téc. 17. Sec. Agric. Ganad., Méx.* 1955, pp. 50, bibl. 11, illus., English summary.

Trials were carried out to study the effect of growing legumes for green manure in association with maize and wheat, under irrigation, at Chapingo, Mexico State, and in Irapuato, Guanajuato, and with maize in Pabellón, Aguascalientes. Many species of legumes were tested. The legumes grew slowly under the cereals but developed rapidly after the cereal harvest and were ploughed under for green manure before another crop of maize or wheat was sown. The results from the trials at Chapingo showed that as much as 5 metric tons of dry matter per ha. were produced in a year by Hubam clover (*Melilotus alba* var. *annua*), 4·1 tons by Willamette vetch (*Vicia sativa*) and 2·1 tons by Toluca vetch (*V. sativa*); in Irapuato these legumes yielded 6·7, 4·5 and 4·7 tons of dry matter per ha., respectively. The results from the trials at Chapingo showed that the best legumes for green manure—Hubam clover, Willamette vetch and white sweet clover (*Melilotus alba*)—increased considerably the yields of the subsequent maize crops, increases of 2 tons of grain per ha. being recorded. At Irapuato the best legumes included *Melilotus officinalis*. The legumes tested at Pabellón gave an average increase of 1 ton of maize grain per ha. over the untreated control plot which yielded 0·88 tons per ha. The inter-sowing of legumes with wheat at Chapingo and

Irapuato gave an average increase in the yield of the following wheat crop of 1 ton per ha. over that of the untreated plots.—E.B.O.

74† Muhamedžanov, M. **[Combining sowings of maize and lucerne in a cotton rotation.]** [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1956, **6**, No. 3, 33–8, illus.

Lucerne is a basic crop in Uzbekistan for stock feed, but to ensure a supply of succulent and concentrated fodders, crops of maize and *Sorghum cernuum* are also essential. Under irrigation in Central Asia the sorghum may surpass maize in yields because it is more tolerant of salty soils and a high water-table. In Uzbekistan, the area sown to maize and *S. cernuum* was 10,000 ha. in 1954 and 120,000 ha. in 1955. It is estimated that to meet the requirements of the cattle in Uzbekistan, at least 200,000 ha. should be under these 2 crops by 1960, but it is not possible to allocate such an area for these sowings under irrigation in the region of the cotton/lucerne rotations. In Uzbekistan, lucerne does not flourish when sown early (end of March/April), and if it is sown in autumn between rows of cotton, the lucerne may be damaged by frost or by cotton harvesting. There are 150–200 thousand hectares used uneconomically in this way for lucerne. From a study made in 1955 (on 115 collective farms covering 1012 ha. in Uzbekistan) it is concluded that lucerne should be sown (16–18 kg./ha. in early June or August) between the rows of a growing crop of maize or sorghum when these are 60–100 cm. high.—M.H.

75 Cosolo, G. Il Cinquantino monfalconese "Cosolo". **[The maize variety Cinquantino monfalconese "Cosolo".]** *Sementi elette* 1956, **2**, No. 6, 44–5, illus.

This semi-flint local maize variety is grown as a catch crop after wheat in the Friuli-Venezia Giulia, Italy. It is sown during 10–30 June at a density of 5·3 plants per sq. m., and harvested during 15–30 October. The yield is 3500–4000 kg. of dry grain per ha.—E.B.O.

76 Brandolini, A. **Insubria 521.** *Maydica* 1956, **1**, No. 1, 17–21, illus. [Sta. Sper. Maiscolt., Bergamo, Italy]

A description is given of Insubria 521, the first maize hybrid bred in Italy by crossing American strains of dent maize (*Zea mays indentata*) with flint strains (*Z. mays indurata*) selected from Italian open-pollinated varieties. In trials in northern Italy, Insubria 521 yielded 8150–8360 kg. of grain (15·5% moisture) per ha., and in trials in central-southern Italy 3990–4020 kg. per ha. The yields of Wisconsin 641 AA, of the same vegetative cycle, were 7790 and 3810 kg., respectively. Yields of Insubria 521 exceeding 10,000 kg. per ha. are recorded.—E.B.O.

77† Kavanagh, L. R. **The sowing of hybrid maize. Results of trials as a guide to growers [for the 1956/7 season].** *Agric. Gaz. N.S.W.* 1956, **67**, Pt. 7, 360–5.

The results of replicated plot trials with hybrid maize for grain, fodder and silage carried out in various parts of New South Wales during the 1954/5 season are given. The principal features of a promising new mid-season hybrid, G.M.211, are outlined. It has good standing ability; is useful for early green fodder; is resistant to cob rots and has a fair resistance to leaf blight. Trials have shown that round and flat seeds of maize hybrids do not differ significantly in their yielding ability, but it is noted that the round seeds tended to give a slightly higher yield.—M.P.

78 Lacroix, L. and Detroux, L. Au sujet du désherbage chimique des cultures de maïs. 2. Essais de l'année 1955. **[Chemical control of weeds in maize cultivation. 2. 1955 experiments.]** *Rev. Agric., Brux.* 1956, **9**, No. 4, 381–98, bibl. 3, illus. [Sta. Phytotechnie, Gembloux (L.L.); and Sta. Phytopharm., Gembloux (L.D.)]

Observations concerning DNBP, MCPA and the Na salt of 2,4-D confirm the results of previous trials [see *Fld Crop Abstr.* 8 : 1233; 7 : 796]. Vaporizing oils enriched with 5% PCP proved to be the most suitable herbicides. They can be applied undiluted at 100 l./ha. and are not harmful to the maize crop. CMU at not more than 300 g./ha. active matter and DNBP at 1300 g./ha. can also be used, but the former is slightly injurious to maize and the latter slightly less effective as a herbicide, especially if there is a spell of rain after application.—D.B.

79 Vengris, J. **Chemical weed control in field corn.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 271–4, bibl. 1. [Massachussets Agric. Exp. Sta., Amherst]

Of the herbicides tested, best results for weed-grass control were obtained from treatment with 2,4-D and dinoseb at 6 lb. per acre. When the herbicides were applied at "laying by" time the most effective chemicals for controlling small seedlings of weed grasses were dalapon and amino triazole.—From *Weed Abstr.* 4 : 752.

80 Veatch, C. **Control of weeds in corn by pre-emergence, emergence and post-emergence treatment.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 265–70, bibl. 4. [W. Virginia Agric. Exp. Sta., Morgantown]

Cultivated plots gave a higher yield of maize than any of the chemically treated plots. Data are given on pre-emergence treatment with 2,4-D (amine, ester), dinoseb, CMU, amino triazole and CIPC,

emergence treatments of 2,4-D, dinoseb, NPA, 2,4-DES, sesin, MCPA, amino triazole and post-emergence treatments of 2,4-D, 2,4-DES, sesin, NPA. Pre-emergence and emergence treatments gave better weed control than comparable post-emergence treatments.—*Weed Abstr.* 4 : 751.

81 RALEIGH, S. M. **Quackgrass control.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 277–8. [Pennsylvania State Univ.]

Various herbicidal combinations were applied to *Agropyron repens*. Amino triazole with 2,4-D and 2,4,5-T gave poorer kills than alone, whilst amino triazole with MCPA was better than amino triazole alone. Amino triazole at 12 lb. per acre killed about 99% of *A. repens*. Maleic hydrazide and amino triazole killed most of the weed without injury to maize, 2,2-dichloropropionic acid and TCA killed most of the weed and the maize. Recommendations for *A. repens* suggested that amino triazole should be applied in spring 10–20 days before sowing maize, then plough, disc and sow. Then cultivate 3 or 4 times during the growing season.—From *Weed Abstr.* 4 : 754.

82 HERD, G. W. **Maize diseases during the 1954/55 season.** *Rhod. agric. J.* 1956, **53,** No. 4, 525–37, bibl. 4, illus. [Fed. Minist. Agric., S. Rhodesia]

The main conclusions drawn from the maize disease trials were that all material of S. Rhodesian origin was fully susceptible to *Puccinia polysora*. Most Natal inbreds on trial showed satisfactory resistance to *Helminthosporium turcicum*. Apparent resistance to streak virus was found in AFRO 235, Sicaragua (Ibadan) and 5 Sabi inbreds. Maize was not attacked by *P. polysora* until after tasseling, but the yield of the maize variety 52DH32 at the Sabi Valley Experiment Station was reduced 25% by the rust, in comparison with maize kept free from the disease by spraying with 2 lb. zineb in 100 gal. of water per ac. There appeared to be a correlation between altitude and the time of onset and severity of the rust, the disease appearing earlier and becoming more severe at lower altitudes. At the Salisbury Station the most severe attack of *H. turcicum* occurred on maize in a stubble-mulch experiment. *H. turcicum* caused a loss in yield of 30% in maize plants not treated with zineb. The effect of excessive weed growth on the incidence of streak virus was observed.—M.P.

83 LEIDERMAN, L. O combate das lagartas de *Heliothis obsoleta* (Fabr., 1793) (Lepidoptera, Noctuidae) em espigas de milho com modernos insecticidas orgânicos. [**The control of the corn earworm** (*Heliothis obsoleta*) **in maize ears with new organic insecticides.**] *Arch. Inst. biol., S. Paulo* 1955, **22,** 13–22, bibl. 3, English summary.

The results from the trials described showed that 0·40% DDT, 0·10% endrin and 0·75% toxaphene plus 5% white mineral oil emulsion, applied as sprays at the rate of 600 l./ha., gave more than 90% control.—From English abstract.

84 KAY, R. E. and PHINNEY, B. **Plastid pigment changes in the early seedling leaves of *Zea mays* L.** *Pl. Physiol.* 1956 **31,** No. 3, 226–31, bibl. 15. [Univ. Calif., Los Angeles]

85 SHUBECK, F. E. and CALDWELL, A. C. **Effects of fertilizers and stand on corn and of stand on soil moisture.** *Tech. Bull. 214. Minn. agric. Exp. Sta.* 1955 pp. 23, bibl. 38.

During 1947–9, field trials with maize were carried out, the variables being the rate and type of fertilizers and the plant populations. The fertilizers used were 10–10–20, 10–20–10, 10–20–20 and 5–20–20 at 100, 200 and 300 lb. per acre. Supplementary nitrogen, after a basal treatment of 200 lb. 5–20–20 per acre, was applied at various rates of nitrogen sidedressing or urea-spray treatments. Stands were varied from 3556 to 17,780 plants per acre by planting by hand 1, 2, 3, 4 or 5 plants in hills 40 in. × 40 in. An increase in plant population resulted in an increased yield up to a limit determined by type of soil, fertilizer used and the moisture supply. The application of fertilizer increased yields, but different rates of different ratio types of fertilizer produced only small differences in yield. Stand had a marked effect on soil moisture, reducing the top ft. of soil to wilting point with 17,780 plants per acre whereas under 3556 plants per acre there was available water in the top ft. of soil. The earlier applications of nitrogen sidedressing, when the plants were 2 ft. high, gave better results than later applications.—G.M.W.

86 WOODS, D. J. and ROSSMAN, E. C. **Mechanical harvest of corn at different plant populations.** *Agron. J.* 1956, **48** No. 9, 394–7. [Michigan Agric. Exp. Sta., E. Lansing]

Total picker losses (gleaned ear maize and shelled maize) averaged 6·0, 6·9, 10·3, and 13·4% of the total yield for average populations of 10,300, 14,900, 18,900, and 22,900 plants per acre respectively, at 6 locations in Michigan. Within the recommended plant populations for Michigan (up to 16,000 plants per acre) there were no significant increases in either ear- or shelled-maize losses as population was increased. Stalk lodging increased and ear size decreased as the population increased but neither was a serious handicap to

mechanical harvest. The % of husk-free ears after picking was not affected by plant population. —From authors' summary.

87 HALL, D. W. **Report on storage problems in Northern Rhodesia.** *Publ. Colon. Office* 1954, pp. 38, illus. [Received Oct., 1956]

Observations made during a 10-day study tour of N. Rhodesia are reported. Particular attention was paid to maize: methods of storage on European and African farms and in depots; losses occurring during storage and disinfestation measures in use. Brief mention is made of the storage of beans, cowpeas, groundnuts, rice, wheat and sorghum. Recommendations are put forward for dealing with the problems encountered.—M.P.

SWEET-CORN

88 LACHMAN, W. H. **Pre-emergence weeding of sweet corn.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 111–13. [Massachussets Agric. Exp. Sta., Amherst]

Effective weed control was obtained in maize with pre-emergence sprays of 15–25 lb. per acre NaPCP, 0·5 lb. per acre CMU, 0·5–1·5 lb. per acre 3,4-DDU, 3–6 lb. per acre DN, 1·5 lb. per acre 2,4,5-TP (ester), 1·5 lb. per acre 2,4-D and 0·75–1·5 lb. per acre TCB. Amino triazole at 1 and 2 lb. per acre produced chlorosis of weeds and crop without killing either.—*Weed Abstr.* 4 : 729

89 RIES, S. K. and GRIGSBY, B. H. **Pre- and post-emergence weed control in sweet corn.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 105–9, bibl. 6. [Michigan Agric. Exp. Sta., E. Lansing]

Experiments were carried out to determine (1) the response of 2 varieties of sweet-corn at 3 stages of growth to CMU, 3,4-DDU and dinoseb; (2) the effects of time of application on yield, weed control and maturity; (3) a comparison of 2,4-D and 2,4-DES with CMU, amino triazole and dinoseb. Both varieties responded similarly to all treatments and none of the treatments significantly reduced yields. Dinoseb at 4 lb. per acre applied in the 3–4 leaf stage delayed maturity, the best time of application being the "spike" stage. The 3,4-DDU was no more effective than CMU.—*Weed Abstr.* 4 : 747.

90 DJJAČENKO, V. S. [**Hereditary changes in sweet-corn in relation to conditions of nutrition.**] [Russian] *Izv. Akad. Nauk, SSSR (Bull. Acad. Sci., USSR)* 1956, No. 3, 50–2. [Moscow State Univ.]

This study was made in the light of Michurin's teaching that the plant organism requires certain environmental conditions at different periods of its development, especially in regard to available nutrients. It is claimed that mineral nutrients determine not only plant growth and development but also ripening, morphology, biochemical state of the seed and other features of agricultural importance. At the Gribov Selection Station during 1952–4, an investigation was made of the extent to which the plant is affected by nutrient supply, with special regard to the stability in the plant of any induced changes in chemical composition. The sweet-corn variety Pionerka Severa, grown in the Moscow Province, comprised the material of the tests which extended over three years (2 replications). The following treatments were applied (kg./ha.): (1) 500 ammonium sulphate, 650 superphosphate, 350 potassium chloride; (2) 500 ammonium sulphate, 650 superphosphate; (3) 650 superphosphate, 350 potassium chloride; (4) control (no fertilizers additional to those of the pre-sowing preparation of the soil). The above nutrients were applied twice, first when the plants were 20–25 cm. in height (formation of generative organs) and then immediately before flowering. The data show that in all treated plants there was some increase in average height of the plants and in cob yields and that the increases were maintained, in varying degree, during 1954. The highest cob yield resulted from variant (2) in which yields were 60% above the control during 1952–4 and 32% in 1954, compared, respectively, with 16% and 9% for (3) and 18% and 2% for (1). In variant (2) there were increases in the percentage of dry matter in the grain, 35·2% in 1952–4 and 34·4% in 1954, compared with 26·6% in the control.—M.H.

91 JACKSON, A. A. and FINN-KELCEY, P. **Drying hybrid sweet corn seed.** *Agriculture, Lond.* 1956, **63,** No. 5, 222–4, illus. [Wye Coll., Univ. London]

A new type of electric drier for sweet-corn and other seeds is described. It is designed to remove surplus moisture slowly at temperatures rarely exceeding those on a hot summer's day. About 8000 lb. of immature stripped cobs were dried in 21 days; each batch of 1–2 tons took 8 days, being kept initially at 60°F. and later at 80°F. The cobs produced 1·5 tons of seed with a germination of 92%. [See *Fld Crop Abstr.* 7 : 814].—J.F.C.

RICE

92 REPP, G. Esperienze colturali in Ungheria. [**Rice-growing trials in Hungary.**] *Riso* 1956, **5,** No. 2, 12–14, illus. [Vienna Univ.]

93 CORDERO di MONTEZEMOLO, M. La colti-

vazione del riso in Costa Rica. [**Rice cultivation in Costa Rica.**] *Riv. Agric. subtrop.* 1956, **50**, No. 4–6, 233–48, illus.

94 Hasegawa, S. and Yamaguti, T. **Effects of briny wind on rice plants. 1. Injuries caused by the typhoons No. 12 and No. 15 in 1954.** *Proc. Crop Sci. Soc. Japan* 1955, **24**, No. 2, 82–7. [Hyogo Agric. Coll.]

The typhoons caused severe injury to rice fields in coastal districts of the Hyogo Prefecture. Normally, the rice leaves contain about 0·4% Cl at heading, but after No. 12 typhoon, the Cl-content reached 9·3% on the coast and 0·8% at 4 km. inland. Salt attached to the leaf surface was removed by rain, but the proportion of residual salt left on the leaves after rain varied according to distance from the coast.—From authors' summary.

95 Crescini, F. and Buffa, G. Andamento stagionale nel periodo della mietitura del riso e qualità industriali del prodotto. [**The effect of weather during rice harvesting on the industrial quality of the product.**] *Ital. agric.* 1955, **92**, No. 12, 841–50, illus. [Ist. Agron. Gen., Milan Univ., Italy]

96 Vialard-Goudou, A. and Richard, C. Étude pluviométrique, physico-chimique et économique des eaux de pluie à Saigon (1950–1954). [**Pluviometric, physico-chemical and economic study of rainwater at Saigon.**] *Agron. trop., Nogent* 1956, **11**, No. 1, 74–92, bibl. 24, illus., English and Spanish summaries. [Inst. Pasteur de Saigon, Vietnam]

From analyses at Saigon, it was calculated that in 1952, '53 and '54, the amounts of inorganic N contributed per hectare by rain-water were 10·4, 7·2 and 15·5 kg. respectively. This N contributes appreciably to rice growth in the rainy season.—From authors' summary.

97 Johnston, T. H. and Cralley, E. M. **Rice varieties and their yields in Arkansas, 1948-1954.** *Rep. Ser. 49. Arkansas agric. Exp. Sta., Coll. Agric. and Home Econ.* 1955, pp. 19, bibl. 9.

98 Hamada, H. **The distribution of Japanese red rice and its characters.** [Japanese] *Proc. Crop. Sci. Soc. Japan* 1956, **24**, No. 3, 147–8, bibl. 3, illus., English summary. [Hyogo Agric. Coll., Japan]

The agronomic characters of up to 32 varieties of long-grained rice and 8–10 varieties of the short-grained, red-rice type are compared. It is concluded that the long-grained varieties are of the *Oryza indica* type and are upland in character whi the short-grained varieties are of the *Oryza japoni* type and are swamp rices. The pigmentation the kernels of the grain of both types of red rice w similar.—From author's summary.

99 Yamada, N. and Ota, Y. **Varietal differ ence in resistance of rice plant to sub mersion under water.** [Japanese] *Pro Crop Sci. Soc. Japan* 1956, **24**, No. 3, 151– English summary. [Nat. Inst. Agric. Sci Tokyo]

In trials with 36 varieties in 1953 and 25 in 195 there was a high positive correlation betwee resistance to submersion and starch- or tota carbohydrate content. There were no significa correlations between resistance to submersion an sugar- or insoluble-N content.—From autho summary.

100 Williams, H. **Weed control problems i rice.** *Proc. 8th Calif. and 15th West. Wee Contr. Conf.* 1956, 110–12.

Rice is more susceptible to 2,4-D at high tempera ture than low. Young plants are more susceptibl than old up to the boot stage ; 2,4-D is mor injurious when absorbed through the roots than b the leaves ; there appears to be no differenc between varieties ; rice is most susceptible t 2,4-D, least to 2,4,5-T with MCPA intermediate.– *Weed Abstr.* 5 : 1407.

101 Kaufman, P. B. and Crafts, A. S. **Re sponses of the rice plant to differen formulations and methods of applica tion of 2,4-D, MCP and 2,4,5-T.** *Hi gardia* 1956, **24**, No. 15, 411–53, bibl. 5 illus. [Dep. Bot., Univ. California, Davis

Both rice and surrounding crops have been injure by aerial sprays of phenoxyacetic-acid herbicide [See *Fld Crop Abstr.* 8 : 1256]. Experiments wer made to determine the effects of 2,4-D, MCPA an 2,4,5-T on rice and weeds, the variables being the methods of sowing the rice seed, the growth stages of rice at the time of applications (at 13, 2 and 46 days), the methods of application (folia aqueous solution or pelleted) and the doses give (1·5, 3·6 and 12 lb. acid equivalent per ac.). Whe aqueous solutions of herbicides were applie directly to the water surrounding the rice plant most damage occurred : where the seed had bee sown on the surface, instead of being drilled at depth of 0·5 in. ; when the plants were in an earl growth-stage ; when high dosages had bee applied and when 2,4-D was used. Pellets cause aberrations in rice and aquatic weeds if the trea ment was given when the plants were young if the dose was high and if 2,4-D was used. MCP was less injurious to rice, but killed weeds. Trea ment with 2,4,5-T was ineffective. At equivalen

dosages, pellets were more selective than aqueous solutions. Pellets caused no injury to rice under greenhouse conditions.—G.M.W.

102 Arai, M. and Miyahara, M. **Studies on weed control by submergence in rice cultivation. 1. Effect of submergence on the structure of weed communities and the quantity of weeds. 2. Effect of submergence on the growth and yield of rice plant.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24**, No. 3, 163–5, bibl. 3, English summary. [Kanto-Tosan Agric. Exp. Sta., Japan]

After rice transplanting was completed, paddy fields were continuously submerged for 1 month under water of different depths. Where the water depth was 10 or 15 cm., weed growth was slight, particularly in respect of weeds resistant to 2,4-D, compared with where a water depth of 3 in. was used. Under 10 or 15 cm. of water, the growth of rice was suppressed at the early tillering stage, but the plants subsequently recovered and became more vigorous than those under 3 in. of water. It was thought possible to secure effective weed control by combined deep flooding and 2,4-D treatment.—From authors' summary.

103 Buenaventura, M. R. **Dormancy periods of promising rice varieties.** *Philipp. Agriculturist* 1955, **39**, No. 10, 558–70, bibl. 6, illus. [Cent. Exp. Sta., Univ. Philipp., Laguna, Philippines]

In general, ordinary variations in daily mean temperature from September to January did not affect appreciably the germination of 46 of the 52 varieties studied. The dormancy periods of the varieties ranged from almost zero (Brondal Poetich) to 11 weeks (Tjahaya). Almost one-third of the varieties had a dormancy period of 5 weeks. Most of the varieties had a gradual rising average cumulative seedling emergence which appeared to be independent of the dormancy period.—Author's abstract.

104 Minabe, M. **Studies on the physical and chemical properties of soft rice. 1. On hardness, 1000-grain weight, specific gravity and water-content.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24**, No. 3, 149–50, English summary. [Fukui Univ., Japan]

For the studies reported, samples of the grain of Norin No. 1 were taken from areas producing either soft or hard rice. The moisture content of the grain of hard rice was about 1% less than that of soft rice and the 1000-grain weight about 1·7 g. lower. The fracture-hardness of soft rice was 1 kg. lower, and the breaking-hardness 0·8 kg. lower, than that of hard rice. Where the moisture content of the grain was held constant at different levels between 10 and 20%, there was no difference in grain hardness. Irrespective of moisture content, the values for the 1000-grain weight of soft rice were about 2 g. more, and the specific gravity about 0·02 units higher, than those of hard rice.—From author's summary.

105 Fujii, Y. and Tanaka, N. **Absorption of oxygen by seedlings of rice plants of various varieties.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1955, **24**, No. 2, 95–6, English summary [Saga Univ.]

Rice seedlings of 14 varieties were grown in water-cultures and the O_2-absorption measured by Winkler's method. The absorption of O_2 and its transference from above-ground parts to roots was faster in early- than in late-maturing varieties. It was considered that the latter are more tolerant of O_2-deficiency.—From authors' summary.

106 Mori, T. **Studies on ecological characters of rice root. 2. The relation between top growth and rooting activity of rice plants.** [Japanese] *Bull. Inst. agric. Res., Tôhoku* 1954, **6**, No. 2, 63–72, bibl. 16, illus., English summary.

Rooting activity of rice, as measured by the number and length of regenerating roots, was greatest at the stage of maximum tiller formation and decreased at heading. It was assumed to be controlled by the relative proportion of nutrients and auxins in the top growth.—D.B.

107 Okajima, H. and Takagi, S. **Physiological behaviour of hydrogen sulphide in the rice plant. 4. Effect of hydrogen sulphide on the distribution of radioactive P^{32} in the rice plant.** [Japanese] *Bull. Inst. agric. Res., Tôhoku* 1954, **6**, No. 2, 73–80, bibl. 19, illus., English summary.

In order to study the mechanism of the injury to rice plants by H_2S, the uptake and translocation of P^{32} in rice plants growing in culture solutions with, and without, H_2S was studied by autoradiography. The absorption of P^{32} by the root and its translocation to the shoot were reduced by the presence of H_2S in the culture medium, and, with an increase in the concentration of H_2S, P^{32} was even exuded into the medium. When P^{32} was applied to the leaf surface it moved to all parts of the plant when there was no H_2S in the culture solution, but it moved only to the stem and ear when H_2S was present in the culture solution.—D.B.

108 Sakamoto, M. **Investigation of low-productive paddy fields near Sendai (1953).** [Japanese] *Bull. Inst. agric. Res., Tôhoku* 1954, **6**, No. 2, 83–117, illus., English summary.

The low-productivity paddy fields consisted of humus-rich muck soils which evolved H_2S gas. The low yield of the rice plants on muck soils was associated with a growth form expressed as a tall plant with few tillers and with a low K-concentration in the plant. Farmyard manure increased the supply of nutrients, especially K, and facilitated their absorption by plant roots. " Mountain" soil increased the grain yield by changing the growth type of the plant from a tall one with few tillers to a shorter one with many tillers, i.e. the growth type found on sandy soils.—D.B.

109 Okajima, H. and Takagi, S. **Physiological behaviour of hydrogen sulphide on rice plant. 5. Effect of hydrogen sulphide on respiration of rice roots.** [Japanese] *J. Sci. Soil, Tokyo* 1955, **26**, No. 8, 323–8, bibl. 19, English summary. [Univ. Tôhoku, Sendai, Japan]

H_2S inhibited both the aerobic and anaerobic respiration of rice roots. The increased uptake of O_2 caused by the addition of ammonium salts was also inhibited by H_2S.—From authors' summary.

110 Takagi, S. and Okajima, H. **Physiological behaviour of hydrogen sulphide in rice plant. 6. Influence of iron, pH and rice plant root on oxidation of H_2S in water culture solution.** [Japanese] *J. Sci. Soil, Tokyo* 1956, **26**, No. 11, 455–8, bibl. 10, English summary. [Tôhoku Univ., Sendai, Japan]

111 Velasco, J. R. and Fertig, S. N. **Relation of nitrogen to calcium in the culture solution.** *Philipp. Agriculturist* 1955, **39**, No. 10, 582–94, illus. [Cent. Exp. Sta., Univ. Philipp., Laguna, Philippines]

Addition of calcium as calcium chloride to a solution high in nitrogen increased growth of rice seedlings. The development of roots was proportionate, within limits, to the increase in N. A N/Ca ratio of about 2 was considered best for optimum development of shoot and root. A nitrate-to-ammonium ratio of 1·7 was found best for rice. A very high ratio of nitrate caused chlorosis of the young leaves. The solution with a high ratio of ammonium produced dark green plants which did not weigh much.—Authors' abstract.

112 Kumura, A. **Studies on the effect of internal nitrogen concentration of rice plant on the constitutional factor of yield.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24**, No. 3, 177–80, bibl. 14, English summary. [Agric. Fac., Univ. Tokyo]

In pot trials, plants of Norin No. 29 rice received either heavy or light applications of N and also supplemental N at different growth stages. There was a high positive correlation between the N content of the leaf blades and tiller numbers. Also the average N content of the leaf blades from 7 to 28 days before heading was positively correlated to a high degree with the number of spikelets per panicle on the main stem. Extreme deficiencies of N at the stage of grain ripening caused a reduction in grain weights.—From author's summary.

113 Matsushima, S. and others. **Crop scientific studies on the yield-forecast of lowland rice. 26. On the mechanism of determining the number of spikelets per panicle in rice plant.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1955, **24**, No. 2, 88–91, English summary.

The number of spikelets on young panicles was studied at 2-day intervals and a maximum was found at about the middle of reduction-division. From the results of thinning-out experiments and of water cultures with adequate fertilization after transplanting, it was concluded that good conditions in the 10-day period from the differentiating stage of 1st.-bract primordia to the beginning of the differentiation of spikelet primordia, were most effective in increasing the number of spikelets; subsequent good conditions did not increase it. Top-dressing at the stage of young-panicle formation, as widely practised, was thought to have little effect in increasing the number of differentiating spikelets, but to be of great value in preventing their degeneration. The result is explained by the fact that the number of spikelets per panicle is strongly correlated with the number of 2nd.-order branches and that 1st.- and 2nd.-order branches differentiate at the time of applying fertilizer. Second-order-branch degeneration is commoner than 1st.-order degeneration and the degeneration of spikelets alone is the least common. It is recommended that fertilizer be applied at the differentiating stage of 1st.-bract primordia and just before reduction division when spikelets are apt to degenerate most easily.—From authors' summary.

114 Carpentier, L. J. **The role of fertiliser in rice production in tropical and semi temperate climates.** *World Crops* 1956 **8**, No. 9, 345–9, 360, bibl. 9, illus.

The author summarizes the conditions and principal characteristics of paddy production in the world. The rotations practised in India, Ceylon, China, Japan, California, Italy, Egypt, Morocco and Portugal are outlined. The fertilizers used in the different countries ; the nutrient requirements of rice ; and fertilizer experiments which have been carried out on rice are discussed. In conclusion, the benefits obtainable from organic and chemical fertilisers, particularly in Asia, are stressed.—M.P.

115 Beacher, R. L. **Rice fertilizer tests, 1954-1955.** *Mimeogr. Ser. 46 Arkansas agric. Exp. Sta.* 1956, pp. 12, bibl. in text.

Zenith rice on old rice land responded poorly to rates of over 80 lb. N/ac., owing to severe lodging, but yields of Bluebonnet 50 continually increased with rates up to 160 lb. N/ac. On better soils, the use of 80 lb. N/ac. or less was considered necessary. Topdressing with P as 16–20–0, or as triple super applied with $(NH_4)_2SO_4$, was profitable in 1954 but not in 1955. The stand and yield of Bluebonnet 50 were depressed by drilling 231 lb./ac. of 16–20–0 with the seed, when high soil-moisture conditions followed shortly after sowing. Differences in time and duration of flooding had slight effects on yields. H_3PO_4 applied in irrigation water gave small yield increases, but liquid 8–8–8, so applied, increased yields significantly.—From author's summary.

116 De, P. K. and Mandal, L. N. **Fixation of nitrogen by algae in rice soils.** *Soil Sci.* 1956, **81,** No. 6, 453–8, bibl. 10, illus. [State Agric. Res. Inst., West Bengal, India]

117 Kawata, S. **Studies on root formation in certain cultivated plants. 3. Relation between primary root formation and canal development in crown roots of rice plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24,** No. 3, 232–6, illus., English summary. [Fac. Agric., Univ. Tokyo]

118 Nagamatsu, T. and Ishikawa, F. **Studies on the geographical differentiation of characters in cultivated rice. 9. Variation of the glume hair density in cultivated rice varieties and their geographical distribution.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24,** No. 3, 185–7, bibl. 5, English summary. [Univ. Kyushu, Japan]

Counts were made of the hairs on the edge of the outer glumes of some 1250 rice varieties from all the main rice-growing regions of the world. Rice from northern regions, such as Japan, Korea, Manchuria, north China, the USSR and USA had their mode in the medium hair-number (60–70) class, though some varieties had hair numbers of over 80. Varieties from southern districts, such as central and south China, Formosa, India and Java had their mode in the small hair number (50–60) class. Varieties from the Philippines were either in the no hair, or rare class (5–35).—From authors' summary.

119 Takeda, T. and Maruta, H. **Studies on CO_2 exchange in crop plants. 4. Roles played by the various parts of the photosynthetic organs of rice plant in producing grains during the ripening period.** [Japanese] *Proc. Crop. Sci. Soc. Japan* 1956, **24,** No. 3, 181–4, bibl. 11, English summary. [Agric. Fac., Univ. Tokyo]

In studies where the ears were shaded, or leaves were either shaded or removed, it was evident that translocation of carbohydrates to the grain was virtually completed at 20 days after heading. About one-third of the grain was derived from assimilates translocated before heading. Shading the ear decreased grain yields by 8%. The apparent photosynthesis of the ear was found to be very low. The flag leaf was not merely an organ of storage before heading, but also contributed to grain yields photosynthetically after heading. The 2nd, 3rd and 4th leaves were more important as storage organs than for photosynthesis. After heading, the photosynthetic activity of the 4th leaf declined markedly, followed by the 3rd, then the 2nd leaves. The flag leaf maintained its photosynthetic activities until a late stage of grain maturation.—From authors' summary.

120 Yamada, N. and others. **Photosynthesis of rice plant. 2.** [English] *Proc. Crop Sci. Soc. Japan* 1955, **24,** No. 2, 112–17, illus. [Nat. Inst. Agric. Sci., Tokyo]

Twelve varieties of rice and various combinations of temperature and light intensity were used, and, separately, CO_2-concentration was varied from 0·5 to 4 times normal. Changes in photosynthetic rate associated with growth stage were observed only under high light-intensity whether the temperature was high or low. At a high light-intensity, the rate was maximal at the stage of most active tillering, decreased until the booting stage and increased again at heading. The decrease after the maximum was more marked in the later-maturing varieties. Each variety was found to have a different rate. Norin No. 1 showed the highest rate under all conditions which may explain its wide adaptability. A very high correlation was found between photosynthetic rate at different stages and water content expressed as a percentage of the fresh weight of the leaves, and, a negative correlation between photosynthetic rate and dry-weight per unit-area. The rate increased with increasing CO_2-concentration up to twice the normal under natural conditions. It was considered that the change in rate caused by natural fluctuations of CO_2-content would be 10% at the most.—[See *Fld Crop Abstr.* 9 : 783.]—J.F.G.

121 Okuhiro, M. **Studies of the effects of nitrogenous fertilizers on the photoperiodic responses of rice plants, especially on the C/N ratio of dry tissue**

powder and on the osmotic pressure, specific electric conductivity and relative viscosity of the expressed sap. [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24,** No. 3, 221–3, English summary. [Univ. Hiroshima, Japan]

Rice plants at young stages of growth were given different photoperiodic treatments for a 50-day treatment. Plants under short-day treatments headed 35 days earlier while those under long-day treatments headed 4 days later than plants exposed to natural-day lengths. A deficiency of N resulted in slight acceleration of heading on the short-day plots and retarded heading on the natural-day length and long-day plots. The C/N ratio, osmotic pressure, specific electrical conductivity and relative viscosity all increased earlier and the water content of the plant tissues decreased earlier in plants on the short-day plots than on the long-day and natural-day-length plots.—From author's summary.

122 Misra, G. **Photoperiodism in rice. 8. Effects of short photoperiod on four varieties of early-winter rice.** *Proc. nat. Inst. Sci., India, Ser. B.* 1955, **21,** No. 5, 201–9, bibl. 26. [Dep. Bot., Ravenshaw Coll., Cuttack, India]

The effects of 10-hr. day treatment on 4 early-winter varieties of rice were studied in pot culture. Treatment for 3–6 weeks retarded ear emergence, but when prolonged until heading caused acceleration. At 6 weeks, in 2 of the varieties, some plants showed retardation and the others acceleration. Treatment for 3–6 weeks increased tiller and leaf production, but, when prolonged, usually caused a considerable reduction. Final height, grain yield, panicle-number and -length were reduced by prolonged treatment. The number of grains set per panicle was increased by 3-weeks' treatment, unchanged by 4–6 weeks, and adversely affected by prolonged treatment. Usually, prolonged treatment caused a small decrease in 1000-grain weight. The results are discussed in terms of the floral-hormone hypothesis.—J.F.C.

123 Misra, G. **Photoperiodism in rice. 9. Response of an early variety of rice to long photoperiod.** *Proc. Indian Acad. Sci. Ser. B.* 1956, **44,** No. 2, 108–13, bibl. 17. [Dep. Bot., Ravenshaw Coll., Cuttack, India]

The effects of 24-hr. photoperiods on the early variety of rice, T.N.32 (Baljati) given to 10-, 20- and 30-day-old seedlings, for 30 days in each case, have been studied in pot culture experiments. The treatment at all stages brought about a significant delaying effect in ear emergence of the main shoot. The grain yield was higher in the 10-day-old treated set, with no marked differences in the 20-day set whereas it was considerably lower in the 30-day set than that from the controls. The higher grain yield was due to a conspicuous increase in the total number of spikelets and grain per panicle.—From author's summary.

124 Seko, H. and others. **Studies on the development of various parts of paddy rice plant. 1. Elongation and changes in dry weight of the parts and organs of rice plant and interrelation among them, during the elongation period.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24,** No. 3, 189–90, English summary.

125 Tanaka, A. **Studies on characteristics of physiological function of leaf at definite position on stem of rice plant. 2. Predominant function of leaf at definite position.** [Japanese] *J. Sci. Soil, Tokyo* 1956, **26,** No. 9, 341–5, bibl. 6, English summary. [Hokkaido Univ., Japan]

The results are given of experiments made to define the characteristic function of the leaves at any given position on the stems of rice plants. The first 2 leaves of seedling plants influenced the power of recovery from transplanting. The 3rd to 5th leaves which emerged after transplanting affected the number of tillers. The 6th to 9th leaves, which emerged during tillering, affected stem elongation and spikelet formation. The 10th to 12th leaves, which emerged during stem elongation, influenced grain maturation. N, which was destined to be incorporated in the grain, was mostly stored in the leaf blades at the time of flowering, while most of the P similarly destined was stored in the stem. Part of the K was already in the ear at flowering, but the majority was absorbed by the grain after flowering.—From author's summary.

126 Tanaka, A. **Studies on characteristics of physiological function of leaf at definite position on stem of rice plant. Part 3 : Relation between nitrogen metabolism and physiological function of leaf at definite position.** [Japanese] *J. Sci. Soil, Tokyo* 1956, **26,** No. 9 and 10, 341–5, 413–18, bibl. 9, English summary. [Hokkaido Univ., Japan]

127† Arashi, K. and Nitta, H. **Studies on the lysigenous intercellular space as the ventilating system in the culm of rice and some other graminaceous plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1955, **24,** No. 2, 78–81, illus., English summary.

he paper deals with the " lysigenous intercellular pace " in the culm, its distribution and process f development and its ecological and specific ariations in rice and other grasses. Aerenchyma n the lower unelongated internodes and lysigenous ntercellular space in the elongated internodes onstitute a ventilating system. The lysigenous ntercellular spaces in the culm and sheath are onnected anatomically through the nodal arenhyma with each other and with the root cortex. he development of lysigenous spaces in the culm better under excessively moist, or O_2-deficient, onditions. The spaces in the culms of species articularly adapted to moist conditions were enerally larger than those in species adapted to ry conditions and develop more extensively ith increasing environmental moistness.—From uthors' summary.

28 YAMANE, I. **Composition of gases from paddy rice field.** [Japanese] *Bull. Inst. agric. Res., Tôhoku* 1955, **6**, No. 4, 187–92, bibl. 5, illus., English summary.
he gases evolved from paddy fields were chiefly H_4 and N_2, and to a lesser extent CO_2, H_2 and O_2. O_2 is evolved in the afternoon as a product f the respiration of algae.—D.B.

29 YAMANE, I. **Manometric micro-analysis of gas evolved from paddy fields (by Van Slyke's apparatus).** [Japanese] *Bull. Inst. agric. Res., Tôhoku* 1954, **6**, No. 3, 119–128, bibl. 10, illus., English summary.
atisfactory results were obtained in the determinaon of CO_2, O_2, CH_4, H_2 and N_2 evolved from addy fields, using an improved Van Slyke's anometer.—D.B.

30 HALL, D. W. **Stored products problems in British Guiana.** *Publ. Colon. Office* 1954, pp. 46, illus. [Received Oct., 1956]
nformation obtained during a week's study tour f British Guiana is given. Considerable attention as paid to the problems connected with rice orage ; these are discussed and recommendations o deal with them are listed.—M.P.

31 ORSENIGO, J. R. **Rice investigations in Venezuela in 1954.** *Publ. 8. IBEC Res. Inst.* 1956, pp. 28, illus.

ENERAL

32 BJAANES, M. Hvilken kornsort bor vi velge ? **[Choice of grain varieties.]** *Norsk Landbr.* 1955, **21**, No. 7, 155–6.
he choice of varieties for the different parts of orway is discussed on the basis of trials made at øystad and elsewhere. Of spring-sown wheat varieties the most important are Diamant II, Ås II and Norrøna. Tabulated information is given on their performance (relative grain yield, lodging, etc.) and behaviour under combine-harvesting in 1954. Similar information, but for the years 1949–54, is given for the 2-row barley varieties Møystad Domen, Weibull's Herta, and Ymer. A short note is given on the 6-row barleys Varde and Asplund. Attention is drawn to the new Finnish stiff-strawed oat variety Sisu, which has been very successful at Moystad and to the varieties Sol II, Blenda, Blixt and Bambu.—G.M.R.

133 ELIASSON, S. and KNUTSSON, G. Sortförsök med höstsäd i Mälar-Hjälmarbygden. Sammanställning av resultaten av sortförsöken med höstvete och höstråg under aren 1945–1953. **[Varietal trials with winter cereals in the Mälar-Hjälmar districts. Summary of results of varietal trials with winter wheat and rye during 1945-53.]** [Reprint from] *Försök Undervism.* 1955, pp. 30. [State Agric. Res. Inst., Sweden]
The region, which lies in east central Sweden and contains the towns of Stockholm and Uppsala, was divided for the purposes of the trials into 8 topographical areas, which are mapped. Fifteen Swedish varieties of winter wheat, 8 Swedish and 1 German variety of winter rye, and 2 Swedish varieties of winter barley, all of which are briefly described, were tested from 1945 to 1953 for their behaviour in the different areas. There is a short discussion of the tabulated results including a comparison of the different varieties, taking Odin as the standard winter wheat and Kungsråg II as the standard winter rye.—G.M.R.

134 OSWALT, R. M. **Wheat, oats, and barley in State-wide variety tests, 1950-54.** *Bull. B-456. Okla. agric. Exp. Sta.* 1955, pp. 35, illus.
A report is given of the performance in Oklahoma of varieties of winter wheat, oats and barley in tests from 1950–4, and of spring-sown oats tested in 2 locations during 1951–4.—G.M.W.

135 WILD, A. S. and REEVES, J. **Cereal variety trials 1955-56.** *J. Dep. Agric. W. Aust.* 1956, **5**, No. 3, 297–309, illus.
The results of variety trials with wheat, oats and barley at the 6 wheatbelt research stations of Western Australia are given, and the recommendations for the 1956–7 sowings are tabulated. The oat variety W.30 has been named Kent and has been released for general cultivation.—M.P.

136 PLAUT, M. and HELLER-COHEN, Ora. **New methods for testing viability of seeds.**

World Crops 1956, **8**, 311 and 319, bibl. 3, illus. [Govt. Agric. Res. Sta., Rehovot, Israel]

The selinite, tetrazolium and resazurin techniques are discussed. The resazurin method [see *Fld Crop Abstr.* 8 : 492] was applied to cereals. After removing the pericarp, the grains were immersed for 6 hr. in a 0·1% solution of resazurin. The seed was considered to be non-viable if the coleoptile or major part of the germ stained blue ; if it appeared to be red or pink the seed was assumed to be viable.—M.P.

137 RANNEM, B. Kvaliteten av skurtresket og vanlig tresket korn. [**The quality of combine-threshed and normally-threshed grain.**] *Norsk Landbr.* 1956, No. 16, 360–2. [Statens Kornkjøp, Gjøvik, Norway]

2789 samples of grain (wheat, barley and oats) offered for sale in 1953–5, some combine-harvested and others harvested with a self-binder and subsequently threshed, were studied for moisture content, hectolitre-weight, and qualitative defects. In each of the 3 spp. and in each of the 3 years, with the exception of oats in 1955, moisture content was higher in the combine-threshed material than in that from the self-binder, the average percentage increase for the 3 years being 1·7% in the case of wheat, 2·6% in that of barley and 1·3% in that of oats. Hectolitre-weight was lower in the combine-threshed material, on an average, by 2·5 kg. in wheat, by 2·3 kg. in barley and by 0·2 kg. in oats. Analysis of ordinary defects incurred in threshing, harvesting, and through adulteration etc. showed these to comprise, on an average, 77% in the combine-threshed as against 70% in the normally-threshed wheat, the corresponding figures for barley being 42% and 23%, and for oats 73% and 36%. The investigations are not considered to indicate any essential difference between the quality of grain harvested by combine and otherwise nor to justify any great difference in price.—G.M.R.

138† ÅBERG, E. Nya rön om skördetröskning. [**Fresh experience in combine-harvesting.**] *Forsøk Forskn.* 1956, **13**, No. 7–8, 81–3. [Agric. Coll., Sweden]

Among points discussed are the correct stage of maturity for combine-harvesting (plants yellow to greyish, moisture content of grain 18–20%) ; the necessity for evenness of ripening, lodging, straw- and axis-breaking in relation to weather and variety ; and seed quality and germination capacity.—G.M.R.

139† FEDOROVA, R. V. [**Differences in the pollen of wild and cultivated grasses.**] [Russian] *Doklady Akad. Nauk, SSSR. (Proc. Acad. Sci., USSR)* 1956, **108**, No. 1, 153–5, bibl. 7, illus. [Geogr. Inst., Acad. Sc USSR]

The size of pollen grains in various grasses (includ ing maize, wheat, rye, barley, oats and millet) i recorded.—M.H.

140 DANTUMA, G. Enkele aspecten van he Kouderesistentie-onderzoek bij granen **Some aspects of the research in cold resistance of cereals.** *Jaarb. CoCoBr* 1955, **5**, 37–43, bibl. 6, illus., Englis summary. [Sticht. Plantenveredelin Wageningen]

The following subjects are discussed : dehardenin (a reversal of the hardening process), and th influence of vernalization status, day-length re sponse and stage of development on cold resistance The following methods were used to establish col resistance and winter hardiness : (a) the freezin of plants in a cold chamber, (b) artificial vernaliza tion for autumn sowing and (c) additional light i winter to lengthen the day, if possible combine with (b).—From author's summary.

141 KREYGER, J. Het drogen van graan in d schuur. **The barn drying of grains.** *Jaarb CoCoBro.* 1955, **5**, 52–8, illus., Englis summary. [Droogtech. Lab., Cent. Ins Landb. Onderz., Wageningen]

The method of barn-drying grains is briefly de scribed. Advantages and disadvantages are ou lined. Practical combinations of preferable figure for thickness of the grain layer, air quantity an temperature, based on semi-technical tests, ar given, besides figures of practical value, obtaine from drying tests in practice.—Author's summary

142† FARM IMPLEMENT AND MACHINERY REVIEW **The "Agrometer" grain moistur tester.** *Fm Impl. Rev.* 1956, **82**, No. 97 459–60, illus.

The instrument described has a stem 30 in. lon the lower portion of which is perforated and con tains a specially prepared bunch of hair, sensitiv to changes in relative humidity. On inserting th stem into the material being tested, the moistur content can be read directly from the calibrate dial, or in the case of certain materials, with th aid of correction charts. The instrument can b used for testing the seeds of various crops, and fo determining the relative humidity of the air.—M.

143 VAN LOY, L. G., and MOERMAN, J. Onde zoek betreffende de nieuwe haksel-dor methode. [**Trial of the new chop threshing method.**] *Meded. LandbHogesch Gent* 1955, **20**, No. 4, 765–94, bibl. 9, illus English summary.

Chop-threshing is the process whereby sheav are passed, unthreshed and with their bands uncu

hrough a chopper-blower, where they are cut nto pieces of 4, 6, 8 or 12 cm. The resulting mix- ure of chopped straw, partly threshed ears, grain nd chaff is blown into a threshing machine of pecial design for complete threshing and cleaning, fter which the straw, grain and chaff are blown by eparate blowers to their respective places of torage. A technical description of the machines s followed by an account of results obtained. One nan is sufficient to operate the installation. Grain rom the thresher can either be blown to the barn r sacked ; in the latter case an additional man is equired.—From authors' summary.

144 National Institute of Agricultural Botany, Cambridge. **The Cereal Field Approval Scheme.** *Publ. 1. Seed Prod. Br.* 1956, pp. 24.

LEGUMES

SOYABEANS

145 Van der Meulen, J. G. J. Beproeving van soja op de Kleigronden van de jonge kustvlakte. **Soyabean trials on clay soils in the young coastal plain.** *Surinaam. Landb.* 1955, **3,** No. 4, 249–67, bibl. 6, illus.

The soyabean has proved one of the best crops for alternating with rice, and can be grown for seed or as a green manure. In Surinam, varieties imported from other tropical countries, especially Indonesia, give the best results. Generally, early sowing gives a better stand than late sowing ; late-sown crops often suffered from too much moisture. Application of fertilizers was not usually necessary but phosphate may be needed in the long run. For the suitable variety Vada, 40 kg. of seed/ha. in rows 40 cm. apart is considered advisable. When grown for seed, in rotation with rice, the yields of rice are likely to remain constant. When soyabeans are used as a green manure for rice, nitrogenous fertilizers need not be applied. Yields of 800–1000 kg. of seed/ha. are considered satisfactory, but 1500 kg./ha. can be reached under favourable conditions.—From author's summary.

146 Veatch, C. **Soybean variety trials in West Virginia, 1947-1953.** *Bull. 370. W. Virginia agric. Exp. Sta.* 1955, pp. 13, illus.

Seed and hay yields are reported for soyabean trials at Morgantown and Point Pleasant. At Morgantown the recommended varieties for seed were Mingo, Chief, Viking, Lincoln, Wabash, Adams, and Perry. For hay production, Chief, Wabash and Perry, together with Scioto and Kingwa, were chosen. At Point Pleasant the choices for seed production were Scioto, Lincoln, Viking, Perry and Wabash ; for hay, Viking was replaced by Kingwa.—G.M.W.

147 Fisher, J. E. **Floral induction in soybeans.** *Bot. Gaz.* 1955, **117,** No. 2, 156–65, bibl. 11. [Sci. Serv., Ottawa, Canada]

Lincoln and Ogden soyabeans were treated with nicotine sulphate at 2000 ppm., indolacetic acid at 200 ppm., and nicotine sulphate with IAA at the above rates, under different photoperiods. In further experiments using 18 hr. photoperiods, mature or immature leaves or growing points were removed. Flowering was induced by short photoperiods, removal of immature leaves, high ratio of mature to immature leaves or spraying the leaves, especially the young ones, with nicotine sulphate. Flowering appears to be induced by a balance between auxin production in young tissues, and a flower-forming substance produced in the mature leaves.—G.M.W.

148 Ishihara, A. **The effect of 2,3,5-triiodobenzoic acid on the flower initiation of soybeans.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1956, **24,** No. 3, 211, bibl. 2, English summary. [Fac. Agric., Univ. Tokyo]

Soyabeans, grown under short-day conditions, were sprayed with TIBA solutions at different growth stages from floral initiation to flowering. Treatments at about 10 days before flowering resulted in marked increases in the number of flower buds. Treatment at earlier stages resulted in greater increases in leaf numbers than bud numbers.—From author's summary.

149 Howell, R. W. **Factors affecting growth of soybeans.** *Soybean Dig.* 1956, **16,** No. 11, 48–9, illus.

The factors investigated were temperature and phosphorus nutrition.—G.M.W.

150 Aso, S. and Kinoshita, M. **Studies on translocation of nutrients in crop plants. Uptake, translocation and distribution of phosphorus, especially contrasted with calcium. 1.** [Japanese] *J. Sci. Soil, Tokyo* 1956, **26,** No. 10. 387–90, bibl. 22, English summary. [Agric. Fac., Univ. Tokyo]

The studies reported were carried out on soyabean plants. It was concluded that the distribution and translocation of P in the plants was dependent on metabolic factors, such as respiration and photosynthesis, while that of Ca was dependent on non-metabolic factors, such as exchange and diffusion.—From authors' summary.

151 Togari, Y. and others. **Studies on the yield analysis of soybean. 1. Changes in principal chemical constituents of the**

soybean plant in relation to its growth. [Japanese] *Proc. Crop Sci. Soc. Japan* 1955, **24**, No. 2, 103–7, English summary. [Agric. Fac., Tokyo Univ.]

Shirobana-sai No. 1, an early soyabean variety, grown under normal conditions, was examined for total sugars, starch, total N, P, K, and crude ash of each organ. Samples were taken at every 10th day throughout the growing period. Before flowering, the increase in all constituents took place very slowly. During flowering, there was a remarkable increase in the accumulation of sugars, starch and K in the aerial parts. This was followed by increases in N, P and crude-ash ; rapid absorption of all these constituents occurred during pod development. Absorption of P and N was similar and continued rapidly up to maturity. In the stems, leaves and pods, all constituents reached their maximum amounts between 10 and 20 days after the end of flowering. In all varieties examined, the leaves were important, with few exceptions, in the accumulation and in translocation of these constituents to the seeds.—From authors' summary.

GROUNDNUTS

152 Evans, A. C. **A study of a rosette-resistant groundnut variety, Asirya Mwitunde.** *E. Afr. agric. J.* 1956, **22**, No. 1, 27–31, bibl. 6, illus. [Tanganyika Agric. Corp.]

A study of the agronomic characteristics of the groundnut variety Asirya Mwitunde is reported.—M.P.

153 Bolhuis, G. G. and Stubbs, R. W. **The influence of calcium and other elements on the fructification of the peanut, in connection with the absorbtion capacity of its gynophores.** *Neth. J. agric. Sci.* 1955, **3**, No. 3, 220–37, bibl. 26, illus. [Lab. Trop. Agric., Wageningen]

154 Prevot, P. and Ollagnier, M. Expérimentation sur les phosphates de la région de Thiès (Sénégal). [**Trials with the phosphates of Thiès region (Senegal).**] *Oléagineux* 1956, **11**, No. 8–9, 545–9, bibl. 3.

Manuring trials with groundnuts in 1953–5, indicated that : (a) the application of 40–75 kg. of dicalcium phosphate per ha. gave increases in yield of up to 1000 kg. of nuts per ha. in the year of treatment, and had also a considerable residual effect ; (b) the application of tricalcium phosphate had no effect ; (c) the application of calcinated aluminium phosphate had a similar effect to that of dicalcium phosphate at Darou but had no favourable effect in other regions of Senegal.—E.B.O.

155 Orgias, A. Efficacité de la fumure minéral de l'arachide dans la région de Daro (Sénégal). [**Effectiveness of chemica manuring of groundnuts in Daro region (Senegal).**] *Oléagineux* 1956, **1** No. 8–9, 577–9, bibl. 1, illus.

The application of 40 kg. of ammonium sulphat 60 kg. of dicalcium phosphate and 20 kg. potassium chloride per ha. is recommended f manuring groundnuts. In field trials, the yiel from unmanured plots, 1400 kg. per ha. on ave age, were 30–40% higher than the average of th region ; this increase was attributed to th favourable rainfall of the year, the high seed ra and good management of the crop. The manure plots yielded 1930 kg. per ha., on average, or 90% more than the average yield of the region.—E.B.O

PEAS

156 Dezeeuw, D. J. and others. **Fungicid and insecticide seed treatments of pea and beans, 1953-55.** *Pl. Dis. Reptr* 195 **40**, No. 8, 727–33, bibl. 6. [Mich. Agri Exp. Sta., East Lansing]

Seed treatments with fungicides, insecticides an combinations of both were tested on Alderma peas and Round Pod Kidney Wax beans. Mo materials containing the fungicides captan, thira and dichlone were beneficial on both peas an beans. The mercury compounds generally gav less consistent protection. One experimenta material, Ethyl B-856, was outstanding in pe trials. Differences in stand due to insecticid applications were not large enough to be stati tically significant.—G.M.W.

157 Rohloff. Möglichkeiten der Anwendun von Orthocid 50 bei der Keimprüfun [**The application of orthocide 50 i germination tests.**] *Saatgutwirtschaf* 1956, **8**, No. 8, 235–6, bibl. 4, illus. [Samen prüfstelle der Landwirtschaftskammer Wes falen-Lippe, Münster, W. Germany]

The use of chlormethylthiophthalimide as a fung cide for pea seed is noted. It can be used at high concentration [not stated] without r ducing germination capacity.—D.B.

158 Cook, W. C. and App, B. A. **The pe aphid on alfalfa and peas and its con trol.** *Agric. Chem.* 1956, **11**, No. 8, 32–3 an 113. [U.S. Dep. Agric., Ent. Res. Br Agric. Res. Serv.]

The pea aphid (*Macrosiphum pisi*) on peas may b controlled by applications of DDT [rate no stated], parathion at 8 oz. in 5 gal. water per acr or by malathion at 16–20 oz. in 10 gal. water pe acre for ground spraying or in 5 gal. water f

aerial spraying. The control from the last treatment is not so good, but it is less toxic to human beings and livestock.—G.M.W.

BEANS

159 Hodgson, G. L. and Blackman, G. E. **An analysis of the influence of plant density on the growth of *Vicia faba*. 1. The influence of density on the pattern of development.** *J. exp. Bot.* 1956, **7**, No. 20, 147–65, bibl. 23, illus. [Dep. Agric., Univ. Oxford]

The competitive effects of varying the density on the development of *Vicia faba* have been studied in a series of multifactorial experiments where the spacing both between and within rows was simultaneously altered. Over densities ranging from 11 to 67 plants per m.² seed production on an area basis tended to be maximal at 35–45 plants per m.² in the winter type and at the highest density for the spring type. As the density increased the number of pods per plant and the extent of branching fell progressively but there was no appreciable change in either seed size or the number of seeds per pod : thus seed production was solely governed by the number of mature pods formed. The number of flowers per plant was more dependent on the number of inflorescences than on the number of flowers per inflorescence. Increasing the plant population diminished the number of nodes bearing inflorescences particularly in the upper part of the shoot, while the size of the inflorescence was decreased to a lesser extent. The number of flowers forming mature pods was very small (9–14%). At the top of the shoot the flowers were infertile, while above the middle node most of the pods formed were shed while still immature. Thus the primary effect of increasing density was to depress the number of nodes on the lower half of the stems which produced mature pods. By the time the flowering stage was reached plant height was already correlated with density due more to a change in internode length than an alteration in the number of differentiated nodes ; at maturity the differences in height were smaller due to the greater number of nodes in the widely spaced plants. For a given density, alterations in the distance between rows had little influence on development. The possible physiological factors responsible for the changing pattern of development brought about by varying density are discussed.—Authors' summary.

160 Greenwood, H. N. **Experiments with field beans at the National Institute of Agricultural Botany.** *J. roy. agric. Soc.* 1955, **116**, 29–33, illus. [NIAB, Cambridge]

This interim report describes variety tests with field beans. Trials are in progress in connection with the use of field beans in stands of dredge corn, their time and rate of sowing, and their irrigation. In 1954, with plentiful summer rainfall, the mixture of winter beans and S.172 winter oats showed higher yields and protein content than either crop grown alone. Preliminary results suggested that mid-October was the best time to sow, and that sowing-rates of over 200 lb. per acre gave no economic return, except in the case of November sowing where high sowing-rates appeared to overcome the disadvantages of late sowing.—G.M.W.

161 Jacks, H. and Webb, A. J. **Field tests for control of broad-bean rust.** *N.Z. J. Sci. Technol. Sect. A.* 1956, **38**, No. 2, 157–9, bibl. 1. [Pl. Dis. Div., DSIR, Auckland]

For the control of *Uromyces fabae*, 12 sprays were tested in the field over 3 seasons. Applications of 0·14% zineb (dithane Z 78) or ziram (fuclasin ultra) at 21–day intervals gave satisfactory control. Manzate, thirospray and spergon gave similar control but for shorter periods.—J.F.G.

ROOTS

SUGAR-BEET

162 Kohler, M. Pflanzenbauliche Versuche mit Monogermsaat im Zuckerrübenbau. **[Trials with monogerm seed in sugar-beet cultivation.]** *Mitt. schweiz. Landw.* 1956, **4**, No. 3, 33–9, bibl. 4, illus. [Eidg. Landw. Versuchsanstalt., Lausanne, Zürich-Oerlikon and Liebefeld-Bern]

As a result of trials with monogerm seed the following recommendations are made. Seed should be sown in a finely-prepared seed bed in mid-April at the rate of 110 g./100 sq. m. (with rows 50 cm. apart) or 140 g./100 sq. m. (with rows 40 cm. apart). Sowing earlier than mid-April requires a further 10–20% of seed. In a moist seed bed, the seed should be sown at a depth of 2 cm. and in a dry seed bed at 3 cm. The Danish method of singling, using a long-handled hoe, saves 30% labour.—D.B.

163 Riedel, K. Die Standraumzumessung als Technisierungsproblem der Rübenpflege. **[Determination of plant spacing considered as a technical problem in sugar-beet cultivation.]** *Kühn-Arch.* 1956, **70**, No. 2, 216–82, bibl. 70, illus. [Martin-Luther-Univ., Halle-Wittenberg, E. Germany]

164 Meier, W. Ergebnisse der Sortenprüfung bei Zuckerrüben 1953–55. **[Results of sugar-beet varietal tests 1953-5.]** *Mitt. schweiz. Landw.* 1956, **4**, No. 4, 52–4. [Eidg.

Landw. Versuchsanstalt, Lausanne, Liebefeld-Bern, und Zürich-Oerlikon]

The varieties Cesena Z and Cesena Za (both Italian) and Kleinwanzleben Polybeta (German) were tested against Kleinwanzleben E, at 6 locations in Switzerland, for productivity, beet yield, sugar content, sugar yield, yield of tops, resistance to *Cercospora* and financial returns [from sugar]. Results are tabulated. Under Swiss conditions, Cesena Z and Za belong to the Normal type. They give a medium sugar yield and a good yield of tops ; they are resistant to *Cercospora* but have a tendency to bolt. Kleinwanzleben Polybeta is almost equivalent to Kleinwanzleben E in sugar yield, but has the advantage over this variety in being resistant to *Cercospora* ; it gives a medium yield of tops. Gross financial returns in Swiss francs per ha. were as follows : Kleinwanzleben E, 4686 ; Kleinwanzleben Polybeta, 4677 ; Cesena Za, 4083 ; and Cesena Z, 3707.—D.B.

165 Flamini, B. and Spreafico, L. L'analisi della germinabilità nei glomeruli di barbabietola. [**The analysis of the germinating capacity of sugar-beet seed-clusters.**] *Sementi elette* 1956, **2**, No. 6, 23–30, bibl. 6. [Ist. Agron., Univ. Bologna, Italy]

In the first of a series of trials to compare various methods of germinating sugar-beet seed-clusters, the germination percentage of seed-clusters germinated in Todaro germinators (made of porous terracotta, and, therefore, kept continuously moist) and in Petri dishes was 65 and 60 after 6 days, and 72 and 70 after 14 days, respectively.—E.B.O.

166 Ulrich, A. **The influence of antecedent climates upon the subsequent growth and development of the sugar beet plant.** *J. Amer. Soc. Sug. Beet Technol.* 1956, **9**, No. 2, 97–109, bibl. 5, illus. [Univ. California, Berkeley]

167 Ulrich, A. and Ohki, K. **Chlorine, bromine and sodium as nutrients for sugar beet plants.** *Pl. Physiol.* 1956, **31**, No. 3, 171–81, bibl. 36, illus. [Univ. Calif., Berkeley, California]

Sugar-beet plants grown without chlorine showed deficiency symptoms in the leaves and roots. These symptoms were corrected by the addition of Cl at 6·7–20 milli-equivalents, or Br at 20 milli-equivalents (the one amount tested) per 3 plants. Chlorine was necessary for top- and root-growth and was associated with sugar formation rather than utilization. Cl-deficiency symptoms were also induced in plants grown by the normal " open culture" technique. The addition of Na to plants low in K increased growth, but had no effect upon plants high in K.—G.M.W.

168 Šugar, Ju. A. **The effect of magnesium on the distribution of sugars in plants** [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1956, **3**, No. 1, 32–5, bibl. 11, illus. [Sci Inst. Ferts Insecto/Fungicides (NIUIF) Moscow]

The distribution of sugars in various organs of th sugar-beet plant under different conditions o magnesium nutrition was investigated with th aim of elucidating the possible role of magnesiun in carbohydrate metabolism. The investigatio was carried out by the paper partition chro matography method. It was found that magnesiun stimulates sucrose synthesis from monosaccharide and also the flow of sucrose located in the leave to other parts of the plant. In order to preven bleaching of the chromatogram spots, an alcoho solution of resorcinol (1% with O·2*N* HCl) wa added to the spot developer (*n*-anisidine phos phate).—From author's abstract.

169 Westesson, L. **Methods of determinin the sugar content of sugar beets** *Socker* 1956, **12**, No. 2, 7–14.

170 Robins, J. S. and others. **Some effects o excess water application on utilizatio of applied nitrogen by sugar beets** *J. Amer. Soc. Sug. Beet Technol.* 1956, No. 2, 180–8, bibl. 4, illus. [Irrig. Exp Sta., Prosser, Washington]

Nitrogen deficiency has occurred in areas of ove irrigation even where N applications were re latively high. During 1953, yields were not reduce by the 3 irrigation levels used. In 1954, variou combinations of excess irrigation at 2- or 4-wee intervals were applied commencing at variou times in the season. N was applied at 0, 120, 24 or 360 lb. per acre and 4 methods of applicatio were used. Yields were reduced where water i excess of that storable in the root zone was applie early in the season. The reductions were greater a lower N rates and where the N had been disce into shallow soils. Sugar content at harvest wa higher with excess water earlier in the seaso than under control irrigation, with greater diffe ences at high N levels.—G.M.W.

171 Netherlands. Commissie ter Bevorderi der Suikerbietenteelt in de Noordelij Provinciën. Rapport over 1954. [**Repor for the year 1954, of the Commissi for the promotion of sugar-beet cult vation in the Northern Provinces** *Meded. Inst. rat. Suikerprod.* 1955, **25**, 1–4 illus.

Investigations reported :

1. Increasing doses of nitrogen, pp. 13–17. Tri in 2 places comparing the effects of applying 9 120, 150 and 180 kg. N per ha. to sugar-b

showed that 120–150 kg. per ha. gave the best results.

2. N, time of application, pp. 18–19. In a plot trial, leaf-, root- and sugar-weight in kg. per acre was greater when N was applied 2 weeks before sowing than when it was given at sowing.

3. Potassium requirements, pp. 19–21. Comparison was made of the effects of applying 100, 200, 300 and 400 kg. K per ha. to sugar-beet. Root- and leaf-weight remained practically constant, whatever the amount of K, and sugar content only showed a very slight but uncertain increase with increasing doses.

4. Singling, pp. 21–5. Tests were made in 2 places of singling by the normal technique, compared with leaving the smallest plants only and leaving the largest plants only. Leaving the largest plants resulted in an increase in leaf, root- and sugar-weight over the other two methods, the increased root weight in one place amounting to 4000 kg. per ha. The poorest results came from leaving the smallest plants.

5. Comparison of normal, polished, and monogerm seed, pp. 25–8. There was little difference in leaf yield from the 3 types of sugar-beet seed and little difference between the leaf-, root- and sugar-yields of polished and monogerm seed, but the highest root- and sugar-yields were obtained from the normal seed.

6. Nitrogen in beet seed-growing, pp. 28–9. The application of N before planting produced the highest seed yield, and in the trial reported 160 kg. per hectare gave the best results : larger amounts of N reduced seed yield.

7. Harvesting sugar-beet seed, pp. 29–30. No difference was found in the yield or quality of sugar-beet seed, whether harvested early (17 September) or 8 days later.—G.M.R.

172 NETHERLANDS, Commissie ter Bevordering der Suikerbietenteelt in de Noordelijke Provinciën. Rapport over 1955. [**Report, for the year 1955, of the Commission for the promotion of sugar-beet cultivation in the Northern Provinces.**] *Meded. Inst. rat. Suikerprod.* 1956, **26**, 1–95, illus.

INVESTIGATIONS REPORTED :

1. Population and planting distance experiment with 2 varieties, pp. 8–12. The sugar-beet varieties KWE and Kuhn P were used, and comparisons were made of 40- and 50-cm. drills and of populations of 75,000, 65,000 and 45,000 plants per ha., respectively. The highest root- and sugar-yields were obtained with the 75,000 population, a finding which confirms the results of many previous trials. With a smaller population, yield was reduced, in which Kuhn P proved to be more seriously affected than KWE. Better results were obtained from 40 cm.- than from 50 cm.-drills.

2. Hail-damage to beet grown in sandy soil, pp. 12–15. Previous trials (1950–5) took place in cultures grown in clay and gravel soil. Hail damage was simulated on 28 July and 24 August by beating down the leaves with a fork, and the beets were lifted on 9 November. Results confirmed the findings of previous experiments that leaf damage incurred from the middle of June to the end of July has the worst effect upon leaf, root- and sugar-yield. At an earlier period fresh leaves are quickly formed : at a later period the leaf reduction does not affect root development so seriously, although fresh leaf formation takes place at the cost of sugar content, which is thereby reduced.

3. Weed destruction with IPC, pp. 15–19. In trials on the use of IPC sprays and dusts at various concentrations, application 14 days before sowing the beets was compared with application when the young plants were in the 4-leaf stage. Leaf-, root- and sugar-yield were less by 2100, 3300, and 580 kg. per ha., respectively, when it was sprayed 14 days before sowing. The maximum quantity of IPC recommended is 7·5 kg. active substance per ha. Presowing treatment is preferred, for which spraying is found more practicable than dusting, and intensive stirring of the spray is requisite.

4. Foliar nutrition of sugar-beet plants, pp. 19–26. To test a Russian theory that foliar nutrition by spraying with K and P 3 or 4 weeks before harvest can improve the yield and quality of sugar-beets [see also *Fld Crop Abstr.* 8 : 153], preliminary trials were carried out spraying with 40% potassium salts, with superphosphate, and with the two together ; but the differences in the results (tabulated) are too slight to lead to any definite conclusion. The experiments will be continued.

5. Cross-blocking, pp. 26–8. This method of sugar-beet growing requires a heavy seeding rate (± 35 kg. per ha.) and cross-harrowing is practised. In an experiment 25 kg. per ha. of the variety KWE were sown in 40 cm. drills and counts of the plants which came up showed 25–30 plants per metre-run. The numbers, according to Russian experiments, should be at least 50–60. After singling, the number of plants remaining was ± 65,000 per ha. (after normal singling the number of plants is 74,000). Singling must be done early ; a delay of a week can result in the loss of 1-3 tons of beet per ha. Yield was not determined, but the experiment is to be repeated.

6. Ridging, pp. 29–31. Comparison of growing sugar-beet on flat land and on ridges showed no advantage in the latter method, root yield, sugar content and leaf yield being on an average somewhat higher on flat land.

7. Singling technique, pp. 31–3. Investigations indicated the advantage, in singling, of selecting and leaving the largest seedlings, which give the best leaf-, root- and sugar-weight.

8. Nitrogenous fertilizers, comparison of quantities, pp. 33–8. The results of 4 trials confirm

previous findings that heavy applications of N to sugar-beet increase leaf weight and have little effect on root yield but reduce sugar content. Thus the higher sugar yields are obtained by applying N at only 110–140 kg. per ha. according to conditions, 120 kg. per ha. being often the most economic.

9. N plus farmyard manure, pp. 38–9. Similar findings to the foregoing are recorded for this trial of different quantities of N, whether applied to sugar-beet with or without farmyard manure. The good results obtainable from well-rotted farmyard manure are stressed.

10. Phosphate dressings, pp. 39–41. In one experiment, application of P to the drills gave better results than broadcasting it. In another, comparing the effect of doses of 30, 70, 120 and 200 kg. P_2O_5 per ha., beet- and sugar-yield reached a maximum at 120 kg.

In addition, the Report contains an account of diseases and pests of sugar-beet in 1955 (pp. 42–9) and a section headed *Miscellaneous* (pp. 50–95) which comprises several short articles on the mechanization of sugar-beet growing, on demonstrations and equipment ; and, further, a discussion of the falling sugar yield in the northern provinces of the Netherlands, and a summary of the most generally applicable results of the Commission's experimental work for the benefit of the grower. These results lead to practical advice on manurial treatment, especially with N, on weed control, sowing technique, choice of varieties, singling technique, and harvesting.—G.M.R.

FODDER-BEET

173 Bakermans, W. A. P. and Hamming, G. Onderzoek naar de factoren, di rendabele bietenverbouw op onze zandgronden beperken 1 en 2. **Investigation into the factors restricting paying beetgrowing on sandy soils. 1 and 2.** *Versl. 61. 14. Landb. Onderz. 's Gravenhage* 1955, pp. 39, bibl. 16, illus., English summaries. [Cent. Inst. Landb. Onderz.]

In the wet year 1948, an investigation into the growth of fodder-beet on light sandy soils was started. The studies were conducted on 160 fields divided into 3 groups according to their origin : (1) old arable lands, (2) former wood or heather grounds, and (3) other fields, partly fairly old arable land, partly ploughed-up grassland. Especially in the first stages of development, ash, as a percentage of the dry matter, decreased both in the roots and leaves. During growth, only the percentages of dry matter and sugar increased. Growth and uptake of ash constituents could, on the whole, be represented by an S-curve. The form of the curve for Ca- and Mg-uptake indicated Ca and Mg deficiency. Crude-protein and Ca-content of the leaves were not clearly correlated with other factors, nor were K and Na contents correlated with yield. The pH and Mg contents of the soil greatly influenced the yield ; for beet-growing their values should be at least 5·8 and 0·0035%, respectively. Where the latter was below 0·003%, the Mg content of the leaves was closely related to the soil Mg-content and to the final yield. The Na and K of the leaves were higher, where the soil K-content was higher. Where the K-uptake was low, the Na-uptake was relatively high and vice versa. The Mg uptake of the leaves was partly determined by the K-uptake. From analysis, ground-water level appeared to be the major yield-factor, the influence of Mg-content being appreciable and that of pH only slight. A higher pH furthered the emergence of beets, and a higher Mg-content and pH both increased the yield of roots but not that of leaves. Drought damage was strongly related to a low water-table. Where pH, Mg- and humus-content of the soil were high, the crop seemed to be less dependent on rainfall. Late harvesting increased the dry-matter content of the beet and lowered the yield of leaves. A very thick organic surface-layer was not correlated with high yields.—From authors' summaries.

174 Statens Forsøgsvirksomhed i Plantekultur. Denmark. Statens forsøg med stammer of foderoer. [**Fodder-beet varietal trials.**] *Medd. 522. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Tidsskr. Planteavl* 1955, **59,** No. 1, 169–70, illus.

175 Josefsson, A. Resultat från försök med foder- och fodersockerbetor. **Results from yield trials with fodder beets and fodder sugar beets.** *Sverig. Utsädesfören. Tidskr.* 1955, **65,** No. 6, 387–401, bibl. 5, illus., English summary.

Tabulated information is given on the content and yield of dry matter in 10 varieties of fodder sugar-beet and 4 varieties of fodder-beet, based on trials conducted from 1947 to 1954 in many parts of Sweden. Fodder sugar-beets are divided into 2 groups in accordance with dry-matter content, whether above or below 17%. In the 4 fodder-beet varieties dry-matter content is comparatively high, ranging from 13·9% to 14·9%. Root shape and dry-matter content are closely correlated, roots with high d.m. content growing deeper and becoming thinner, more angular, and more difficult to harvest. The dirt percentage is generally higher in the high-percentage strains. The low-percentage strains have comparatively less sugar but more protein than high-percentage strains. In any case, crude-protein content is rather low, i.e. 5–7% of the dry matter, but as beets give a high yield of dry matter per acre, varietal differences are not

without importance. High-percentage strains keep better than low-percentage strains.—G.M.R.

176 Buysse, F. Het voorkomen van nitraten in bieten en stoppelknollen. [**Nitrates in fodder-beets and turnips.**] *Meded. LandbHogesch., Gent* 1956, **21**, No. 1, 59–66, bibl. 3, English summary.

Nitrates, expressed as potassium nitrate, in the dry matter ranged from 0·31 to 4·51% in fodder-beets and from 0·34 to 4·47% in turnips. Different methods of determination are compared.—G.M.R.

177 Bakermans, W. A. P. Toevoeging van Conserbeta of van grond tegen kuilrot bij voederbieten. [**The use of Conserbeta or soil against rotting of fodder-beet in the clamp.**] *LandbVoorl.* 1955, **12**, No. 11, 493–9, bibl. 10, illus.

In inter-provincial trials in 1952–5 and in a separate trial at De Rips in 1954–5, an investigation was made into the degree of rotting of fodder-beet (a) in normal clamps, (b) treated with Conserbeta (active material TCNB) before clamping, (c) treated by the addition of soil before clamping. Conserbeta was used at rates of 1·25, 2·5, 3·5 and 4·5 kg. per ton of beet. Conserbeta at rates of 2·5 kg. per ton or more gave good control of losses from the various rots which included those caused by *Botrytis cinerea*, *Phoma betae* and *Helicoasidium purpureum*; the spread of the last rot was halted. In the De Rips trial, the loss of dry-matter in the beet during clamping was reduced by 7·4% by the addition of Conserbeta. Although the addition of soil gave some control, it also gave rise to increased temperature, some spread of *H. purpureum* and increased root-formation in the clamp.—W.J.B.

POTATOES

178 Laird, R. and Meiklejohn, A. K. M. **Ware potatoes. Early and maincrop.** *Adv. Leafl. 15.* (*N.S.*) *Dep. Agric. Scot.* 1956, pp. 12.

The common practices adopted in the production of ware crops in Scotland are outlined. The brief notes given on the chief varieties grown commercially relate to Scottish conditions.—M.P.

179 Roer, L. Forsøk med forskjellige settepotetstørrelser og med ulike setteavstander. **Experiments with different sizes of seed potatoes and with different planting distances.** *Forskn. Fors. Landbr.* 1955, **6**, No. 1, 17–41, bibl. 24, English summary. [Fm Crop Inst. Agric. Coll., Norway]

In trials during 1942–8, using Kerrs Pink and Arran Consul, the sizes of seed potato used ranged from 12·5 to 250 g., some of the 100 g. tubers being halved, and some being cut into single-eye seed-pieces of 20 g. each. The distance between the drills was 65 cm. and the spacing between sets 30 cm. The number of stems per hill increased with increasing size of seed. Sprouts from the largest seeds emerged more rapidly and showed greater vigour than those from smaller seed-tubers. The results suggested that the number of tubers per plant increased as seed-size and number of stems increased. The tuber-number per stem decreased with increasing numbers of stems per plant (Kerrs Pink), and the number of tubers per unit weight of seed-tuber decreased with increasing seed-size. The average tuber weight decreased as the seed-size was raised, but the total yield rose with an increase in size of seed-tuber, the total yield being significantly proportional to the weight of the seed-tubers. The significant interaction between variety and seed size indicated that a variety with a very low number of stems and of tubers (Arran Consul) reacted more favourably to an increase in seed-size than one with a more normal tuber- and stem-development (Kerrs Pink). The highest net yield was obtained by using 50- and 100-g. tubers of Kerrs Pink and Arran Consul, respectively, but small seed-tubers were economically comparable. The highest returns were given by 25- and 50-g. tubers of Kerrs Pink. For Arran Consul, 50g.- and 100g.-tubers were best. Experiments with different spacings of sets during 1944–50 are also considered. Spacings of 20, 30, 40 and 50 cm. were chosen, using 50- and 100-g. tubers of local varieties. An increase in spacing raised the number of tubers per hill and the size of tubers, but the increased yield per plant did not compensate for the reduced plant number. Highest total yield was obtained at a spacing of 20 cm., and net yield at 30 cm. Closer spacing was more favourable in years of good yield. Large seed-tubers were able to utilize a more open spacing than medium tubers. Economic returns were better from 50 g.- than from 100 g.-seeds. In years of good yield, a spacing of 30 cm. was the most economic with medium-sized seeds, otherwise the 3 widest spacings gave about the same net returns. With large seeds, the widest spacing was best especially in years of low-yield. Under favourable conditions, a spacing of 40 cm. was as good as 50 cm.—From author's summary.

180 Münster, J. La valeur de la plantation tardive des pommes de terre pour la production du plant. [**The value of late planting of potatoes for (subsequent) production.**] *Rev. rom. Agric.* 1956, **12**, No. 7, 53–5, bibl. 1. [Stat. Féd. Essais Agric., Lausanne, Switzerland]

Following up the work on the influence of date of planting on the health of the crop [*Fld Crop Abstr.*

8 : 187], the development of the progeny of the early-planted (April) and the late-planted (end July) potatoes was tested. The progeny of early-planted potatoes at first grow more vigorously, and if subjected to removal of tops in July to avoid virus infection, they give higher yields of tubers than the progeny of late-planted potatoes. On the other hand, the growth of the latter overtakes that of the former, and if development is allowed to continue to maturity, yields of tubers are similar.—D.B.

181 IVINS, J. D. and MONTAGUE, V. J. **Agronomic factors affecting yield of potatoes.** *Rep. Univ. Nottingham, Sch. Agric.* 1955, 38–9, bibl. 2.

From a preliminary survey in 1953 it was found that in an apparently uniform crop, the yield of individual plants varied from 16 to 270% of the mean yield. During 1954, tests were made to ascertain the effect of various factors in an attempt to obtain a more uniform and a higher-yielding crop. Time of emergence, number of stems per plant, size, weight and number of ware and seed tubers were recorded for King Edward potatoes. The effect of spacing had been investigated. [See *Fld. Crop Abstr.* 8 : 928]. Large seed tended to produce a greater number of stems and tubers per plant. Early emergence was advantageous. Delayed emergence resulted from desprouting and planting tubers downwards instead of upright. In 1955, Majestic potatoes were found to produce poor tubers at wide spacings (up to 32 in. apart). Shallow planting increased the number of tubers. Irrigation led to a 100% increase in yield of ware (over 1·75 in.) tubers during the dry summer of 1955. [See also *Fld. Crop Abstr.* 8 : 928.] There was no evidence of hereditary differences in plants producing high and low yields.—G.M.W.

182 DUIN, R. H. A. van and SCHOLTE UBING, D. W. De invloed van het weer op de opbrengst van de aardappel. [**The influence of weather on the yield of potatoes.**] *Landb. Tijdschr.* 1955, **67**, 11–12, 795–802, bibl. 6, illus.

Data on the yield of Eigenheimer potatoes in the Netherlands and mean monthly temperature and rainfall in the period 1940–52 were examined. The correlation between weather and yield was greatest in the month of July (the period of tuber formation for the variety investigated). Moisture deficiency was calculated following Penman's method. The highest yields coincided with a mean July temperature of 16–18°C. and with a total moisture deficiency less than 8–12 cm. over the whole growing season.—W.J.B.

183 KRIJTHE, N. **Observations on the formation and growth of tubers on the potato plant.** *Neth. J. agric. Sci.* 1955, 3 No. 4, 291–304, bibl. 6, illus. [Inst. Potat Storage, Wageningen]

An account is given of an investigation, to b continued for several years, on the relationshi between chitting, number of sprouts on the see potato and the grading of the harvested potatoe The influence of the following treatments on tube growth (one treatment per year) was studied : (1 methods of chitting ; (2) size of seed potatoes an (3) storage condition. After the first fortnight growth, whole, sample plants were lifted weekl to study the position of stolons on the stems, an the location of the largest and smallest tubers o the plant, the size of tuber being judged by i length. At each lifting, the relative positions the largest, the smallest and of the medium-size tubers were the same on each plant. These pos tions were approximately the same in differe varieties of potatoes, and the general scheme shown diagramatically. The treatments (1), (2 and (3) showed no significant effects on formatio and growth of tubers provided the sprouts of th seed potatoes were the same length. The phe omenon of secondary-tuber formation is discusse —D.B.

184 KELLER, E. R. Bericht über Hauptve suche mit neuen Kartoffelsorten 1953–5 [**Report on the main trials with ne potato varieties 1953-5.**] *Mitt. schwei Landw.* 1956, **4**, No. 5, 65–75.

Six varieties in the series medium-early to la types were tested for yield, chemical compositio and resistance to various diseases. The varieti were : Augusta, Benedikta, Maritta, Capell Voran and Ackersegen. The first 3 varieties we admitted to the Swiss official list.—D.B.

185 ANDERSEN, T. Forsøg med kartoffelsort 1949–1954. [**Potato varietal trials, 194 54.**] *Tidsskr. Planteavl* 1955, **59**, No. 571–600. [Sta. Res. Crop Husbandr Denmark]

The trials were conducted at 6 places havi different soil types and were concerned first with 6 varieties of early, cooking potatoes, Bint being taken as a standard variety. The highe yield of tubers was given by Craigs Defianc followed by Arran Banner and Record, whi Bintje and Katahdin had the lowest yield. Th yield of medium-large tubers, 30–50 mm., w largest with Craigs Defiance and Bintje. The be qualities were found in Bintje. Record also show very good quality, but had a tendency to break cooking. Bintje and Katahdin were the earlie Matador and Arran Banner the latest, varieti With the exception of Bintje and Katahdin, all th varieties tested proved immune to wart disea The trials also tested 7 varieties of late potato

used for fodder or processing, Alpha and Dianella being the standard varieties. Tylstrup 44,346 was considerably superior to the other varieties in yield of dry-matter, followed, in order, by Dianella, Tylstrup 38,125 and Urtica. The percentage dry-matter content was highest in Dianella and Urtica and lowest in Tylstrup 38,089 and Alpha. Tylstrup 44,346 was the variety most resistant to mould, and Tylstrup 38,125 and Alpha the most susceptible varieties. The Tylstrup varieties 44,346 and 38,089 are susceptible to wart disease and will not therefore be placed on the market. The other varieties proved immune to wart disease.—G.M.R.

186 STATENS FORSØGSVIRKSOMHED I PLANTEKULTUR, DENMARK. Forsøg med kartoffelsorter 1951–54. [**Potato varietal trials, 1951-4**] *Medd. 538. Stat. Forsøgsvirk. Plantekult.* [Contained in]. *Tidsskr. Planteavl* 1955, **59,** No. 4, 729–32.

The trials reported in *Medd, 514* [see *Fld Crop Abstr.* 8 : 1332] were continued. Of the medium-early, culinary potatoes, Bintje, which is taken as the standard variety, gave a somewhat lower yield than the other varieties except Katahdin, but Bintje's quality was the best of all the varieties. Record was also found to be of very good quality apart from a tendency to break in cooking. Of the late varieties tested for fodder and for industrial use, Dianella—except for Tylstrup 44346—gave the highest yield of dry matter and its percentage dry-matter content was high. Tylstrup 38125 and Urtica, which followed Dianella most closely in productivity, have small tubers.—G.M.R.

187 STATENS FORSØGSVIRKSOMHED I PLANTEKULTUR, DENMARK. Forsøg med tidlige, brokimmune sorter af spisekartofler 1950-53. [**Trials of early potato varieties immune to wart disease, 1950-3.**] *Medd. 535. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Tidsskr. Planteavl* 1955, **59,** No. 4, 723–4.

Six early, wart-immune potato varieties were grown in clay soil at Virum and in sandy soil at Spangsbjerg and Hornum. They were lifted (1) from the last week in June to the first in July, (2) 2–3 weeks later, and (3) when fully mature. Primula, an already-tested, yellow-fleshed variety was taken as the standard. It was followed by Arran Pilot and Ulster Chieftain as the two most productive varieties at the first lifting, and then by Ulster Commerce, Saskia and Ulster Premier. Arran Pilot gave the highest yield in the second and third liftings also, and is considered to be a useful white-fleshed variety.—G.M.R.

188 INGERBRIGTSEN, S. Forsøk med tidlige potetsorter. **Variety trials with early potato varieties [in Norway].** *Forskn. Fors. Landbr.* 1956, **7,** No. 1, 1–9, bibl. 5. English summary. [State Exp. Sta. Holt, Tromsø]

The trials were carried out in 1945–52. The mean planting date was 2 June, with 28 May as the earliest and 9 June as the latest date. Harvesting dates were 10, 20 and 30 August. Epicure gave the largest yield of marketable tubers at all 3 harvesting dates, exceeding the standard variety Immune Emperor's Crown by 294, 223 and 109 kg./decare, respectively. The total number of tubers was about the same for both varieties at the first harvest but in the later harvests was less for Epicure. Arran Pilot was comparable with the standard in the first harvest only.—J.F.C.

189 INGEBRIGSTEN, S. Forsøk med potetsorter. [**Potato varietal trials.**] *Forskn. Fors. Landbr.* 1956, **7,** No. 5–6, 459–76, bibl. 13, English summary 476. [State Exp. Sta. Holt, Tromsø]

Trials of 20 different potato varieties were made from 1945–54, a total of 30 plots being harvested, 16 at the Holt Station, the remainder elsewhere in Tromsø. Arran Banner and Immun Keiserkrone gave the biggest tuber yields but were found to have a relatively low dry-matter content. Up to Date, Arran Comrade and Saga gave large yields and the 3 varieties are recommended to district farmers even though the dry-matter content of Up to Date and Arran Comrade is below average. On soil especially suitable for potato growing, however, more saleable varieties with a higher dry-matter content, such as Kerrs Pink and Jøssing, should be used. Of high-quality, table potatoes, Gullauge gave the highest yields.—From author's summary.

190 ZUBELDÍA L., A. and others. Estudio, descripción y clasificación de un grupo de variedades primitivas de patata cultivadas en las Islas Canarias. [**Study, description and classification of a group of primitive varieties of potato grown in the Canary Islands.**] *Bol. Inst. Invest. agron., Madr.* 1955, **15,** No. 33, 287–325, bibl. 12, illus., English summary. [Esta. Mejora de la Patata, Vitoria, Spain]

The 10 potato varieties described have been grown in the Canary Islands for a long time (probably since early in the 17th century). Seven of them belong to *Solanum andigenum*, 2 to *S. tuberosum* and one, a triploid, is related to *S. mamilliferum* from Peru.—E.B.O.

191 SAWYER, R. L. and DALLYN, S. L. **Preemergence herbicides and cultivation for weed control in potatoes.** *Proc. 9th. Northeast. Weed Contr. Conf.* 1955, 227–9.

A comparison was made of CMU at 1·5 lb. per acre, 3,4-DDU at 1·5 lb. per acre, PDU at 1·5 lb. per acre, dinoseb at 1 gal. per acre, NaPCP at 15 lb. per acre, 24-DES at 4 lb. per acre, sesin at 4 lb. per acre and natrin at 4 lb. per acre for weed control in potatoes with observations on potato-foliage tolerance, yield and specific gravity of tubers. Taking all these factors into consideration dinoseb was the most satisfactory. The urea compounds caused considerable reduction in yield and specific gravity. The phenoxy compounds damaged the foliage.—*Weed Abstr.* 4 : 728.

192 Hooker, W. J. **Foliage fungicides for potatoes in Iowa.** *Amer. Potato J.* 1956, **33**, No. 2, 47–52, bibl. 3, illus. [Iowa Agric. Exp. Sta., Ames]

During 1946–52, experiments were made to compare the effects of copper-containing fungicides with those of new organic fungicides in the control of early and late blight (*Alternaria solani* and *Phytophthora infestans*). All plots of Cobbler potatoes, including the untreated control, were sprayed with DDT to control leaf hopper. Weather affected the annual intensity of infection, but in 1950–2 there was 99–100% defoliation in untreated plots. In these years, control with Bordeaux mixture resulted in 30, 53 and 36% defoliation, and control with zineb-type fungicide resulted in 35, 35 and 19% defoliation. Yields for the same years were 387, 217, and 512 bu. per acre with Bordeaux-mixture sprays, and 426, 301 and 601 bu. per acre with zineb sprays. Results with tribasic copper-sulphate, copper zinc chromate, ziram and maneb are also given.—G.M.W.

193 Wilson, J. D. and Sleesman, J. P. **Depression of potato yields by Bordeaux mixture during a dry summer.** *Amer. Potato J.* 1956, **33**, No. 6, 177–84, bibl. 16. [Ohio Agric. Exp. Sta., Wooster]

During an experiment in which various spray treatments were compared, it was noticed, during the dry season of 1954, that where Bordeaux mixture had been used alone or in combination with other treatments, the yield was decreased. On 14 October yields from (1) the control plots, (2) the plots treated with zineb and a mixture of DDT and dieldrin, and (3) the plots treated with Bordeaux mixture only were 429, 436 and 366 bu. per acre, respectively.—G.M.W.

194 Meier, W. and Keller, E. R. Bericht über das Auftreten von Kartoffelblattläusen im Jahre 1955. [**Report on the occurrence of potato-leaf aphids in 1955.**] *Mitt. schweiz. Landw.* 1956, **4**, No. 6, 92–7, illus. [Eidg. Landw. Versuchsanst., Zürich-Oerlikon]

In this report, the latest dates for killing tops of the potato crop in 1954 and 1955 are given. For altitudes of 400–500 m. the dates vary from 11 July to 2 August according to variety. For altitudes of 600–800 m. the date is 7 days later, and over 800 m. it is from 10–14 days later. In the low areas of northeast Switzerland it is 4–6 days earlier. [See also next abstract.]—D.B.

195 Keller, E. R. and Weiss, R. Über Erfahrungen beim Totspritzen von Kartoffelfeldern. [**Experience gained in spray-killing of potato tops.**] *Mitt. schweiz. Landw.* 1956, **4**, No. 6, 97–104, bibl. 3, illus. [Eidg. Landw. Versuchsanst., Zürich-Oerlikon]

One of the conditions for certification of class A seed potatoes is that all tops should be destroyed by a given date, fixed each year by the Federal Experiment Stations at Zürich and Lausanne [see previous abstract]. The enforcement of this regulation has resulted in virus-free tubers and has given confidence to buyers. On small farms the pulling of tops is the most economical method of destruction. On larger farms, the tops are killed by spraying with caustic chemicals 5 days before the appointed date to allow time for complete death of the tops. The tops, particularly the stems, are injured and sprayed preferably simultaneously, and the operation is repeated a few hours later, working from the opposite direction. In the experiments in Zürich-Oerlikon, the DNC compounds best combined their caustic action with an absence of undesirable side effects. The following, used in a concentration of 1·5 to 2·0%, are recommended: tufan at the rate of 2000 to 2400 l./ha. ; EK54 at 2000 to 24000 l./ha. ; and deramo at 1600 to 2400 l./ha., according to the potato variety. The effectiveness of the treatment varied according to the weather and the vigour of the plant. Suitable machinery is described. The tubers are lifted 2–3 weeks after burning or pulling of the tops, i.e. when the skin has formed on the tubers. Killing the tops of ware potatoes in this way, using 1500 l./ha. at a concentration of 1·5%, halved the number of diseased tubers, and at the same time acted as a herbicide. The flavour of the potatoes harvested 2–3 weeks later is not affected if the chemical is applied according to instructions.—D.B.

196 Frimmel, G. Über Hormone in Kartoffelpollen. [**Hormones in pollen of the potato plant.**] *Bodenkultur* 1956, **8**, No. 4, 349–51, bibl. 5. Kartoffelzuchtsta., Anzberg, Austria]

The hormone content of pollen of *Solanum tuberosum* is low, and this can account for the difficulty in producing true seed of this crop. Hormones from pollen of other species, e.g. *Lathyrus*, can be used to assist the growth of the pollen tube.—D.B.

97 Bushnell, J. **Exploratory study of the rate of oxygen consumption by potato roots.** *Amer. Potato J.* 1956, **33**, No. 7, 203–10, bibl. 10, illus.

With the aim of finding a physiological reason for the sensitivity of potatoes to soil porosity, exploratory studies were made on rate of oxygen consumption by potato roots growing in pots of gravel. The data were obtained from young plants at an early stage of tuber formation. In 3 tests the roots absorbed oxygen at rates ranging from 5·7 to 12 ml. per hr. per g. of oven-dry roots. This is a much higher rate —5 to 100 times higher— than reported for other plants or indicated by studies of root respiration. The presence of moderate concentrations of CO_2 in the air around the roots did not interfere markedly with their rate of absorption of oxygen.—Author's summary.

98 Bushnell, J. **Growth response from restricting the oxygen at roots of young potato plants.** *Amer. Potato J.* 1956, **33**, No. 8, 242–8, bibl. 8, illus. [Ohio Agric. Exp. Sta., Wooster]

Two tests were conducted with 4 pots each of Irish Cobbler potatoes in gravel culture to observe the growth response from supplying their roots with air mixtures containing less than the normal proportion of oxygen. In both tests the growth response to air with 0·75 normal oxygen (15%) was a conspicuous increase in the development of above-ground branches, and some reduction in the growth of the tubers. Only one test was made with air mixtures reduced to 0·5 and 0·25 of normal oxygen. Under these treatments the young tubers became abnormal in shape. The tops were not conspicuously affected. Treatment with 0·75 normal oxygen did not appreciably affect the amount of nutrient solution absorbed by the roots, or the amount of CO_2 respired by the underseal parts of the plants.—From author's summary.

99 Grosch, H. G. Weitere photoperiodische Versuche an Kulturkartoffeln. [**Further photoperiodic experiments with potatoes.**] *Z. Acker- u. Pflbau* 1956, **101**, No. 3, 301–20, bibl. 33, illus. [Inst. Boden- u. Pflbaulehre, Univ. Bonn, W. Germany]

The experiments reported in the latter half of *Fld Crop Abstr.* 8 : 943 were repeated and found to be reproducible. Pot experiments were also carried out with sprouted Deutsche Erstling to study the effect of date of planting (from March to June) and different rates of N application (1g. and 3g. N per pot) on the growth and development of the potato. The staggered planting dates produced different photoperiodic treatments. Day length at time of emergence proved to be the decisive factor in development of the potato. The short-day effect at time of emergence, produced by early planting, resulted in early tuber formation and rapid tuber development, while the tops remained short and died relatively early. The long-day effect at time of emergence, produced by late planting, resulted in tall branched tops which soon developed reproductive organs. The tops of these plants were able to continue assimilation over a longer period than those which emerged during short-day, consequently they produced a tuber yield as high as, or even higher than, those planted in March despite the later tuber formation. In the plants which emerged in short-day, N was used more for tuber development and in the long-day plants it was used mostly for tops. Plants receiving 3g. N (per pot) produced almost twice as much top growth as plants receiving 1g. N. However, as day-length on emergence increased, the effect of the 3g. compared with 1g. N became more marked as regards increase in the top growth but less marked as regards the increase in the tuber growth. The combined effect of day-length and N manuring is such that it pays to give heavy N manuring to early potatoes.—D.B.

200 Steineck, O. Die Jugendentwicklung einjähriger Kartoffelsämlinge unter verschiedenen Tageslängen bei Topfkultur. [**The early development of 1-year-old potato seedlings in pots under different day-lengths.**] *Bodenkultur* 1956, **8**, No. 4, 374–81, bibl. 10. [Hochsch. f. Bodenkultur, Wien, Austria]

The photoperiod experiments on 2-year-old potato seedlings [*Fld Crop Abstr.* 7 : 1280] were extended to 1-year-old seedlings grown in pots. The seedlings were the progeny of Flava × Saskia and of Flava selfed. The seedlings reacted to day-length (12 hr. and normal) at an early stage. Seedlings grown under short-day (12 hr.) produced markedly broader leaves and a more compact growth than those grown under normal day-length. They produced more stolons and tubers and heavier tubers than did seedlings under normal day-length.—D.B.

201 van Schreven, D. A. **On the physiology of tuber formation in potatoes. 1. Premature tuber formation.** *Plant and Soil* 1956, **8**, No. 1, 49–55, bibl. 20, illus. [Microbiol. Lab. Zuiderzee Recl. Works, Kampen, Neth.] [Received December, 1955]

Tubers of the early variety Duke of York were stored at (a) room-temperature in the dark, when they lost much of their reserve materials and water, and (b) a lower temperature, when they remained in good condition and produced short sprouts. Both lots were desprouted in May and planted in tumblers of sandy loam. Each lot was then divided into 2 groups, one being grown at room tempera-

ture in the dark and the other at 5–9°C. in a refrigerator. Pregermination of the tubers in the dark, and low-temperature growth, favoured premature tuber formation. Pregermination in the dark and desprouting caused earlier development of young tubers, with feeble shoot- and root-formation. Low temperature retarded shoot- and root-formation. Premature tuber formation occurred at room temperature only when the mother tubers were very small and had lost much reserve material in storage. It appeared to be correlated with conditions which checked root- and sprout-formation after planting, but not necessarily with loss of reserve materials in the mother tuber.—From author's summary.

202 VAN SCHREVEN, D. A. **On the physiology of tuber formation in potatoes. 2. Influence of some organic compounds on tuber and sprout formation of potatoes aseptically grown in the dark.** *Plant and Soil* 1956, **8**, No. 1, 56–74, bibl. 31, illus. [Microbiol. Lab. Zuiderzee Recl. Wks, Kampen, Neth.] [Received December, 1955]

Pregerminated and non-pregerminated tubers of Duke of York potatoes were allowed to germinate in the dark and take up pure water or solutions of organic substances. The formation of young tubers occurred earlier after they had been pregerminated in the dark at room temperature. Earlier tuber formation was correlated with a high ratio (R) of soluble carbohydrate to soluble non-protein N. The formation of young tubers was much delayed by sugars in the solution ; this may be attributed to impeded water absorption and slower starch breakdown in the mother tubers. Nitrogenous organic compounds delayed the formation of young tubers and the breakdown of starch in mother tubers ; the poor and retarded formation of young tubers was correlated with a low R in the tubers and sprouts. The results are discussed in connexion with the problem of premature tuber formation.—From author's summary.

203 VAN SCHREVEN, D. A. **On the physiology of tuber formation in potatoes. 3. Influence of growth substances (phytohormones) on tuber and sprout formation of potatoes aseptically grown in the dark.** *Plant and Soil* 1956, **8**, No. 1, 75–86, bibl. 44, illus. [Microbiol. Lab. Zuiderzee Recl. Wks, Kampen, Neth.] [Received December, 1955]

Small amounts (0·01–0·1 ppm) of 2,4-D, applied to a culture of non-pregerminated tubers, caused a marked increase in numbers and yield of young tubers. With pregerminated tubers, the formation of young tubers occurred earlier and their yield increased considerably in the presence of small amounts (0·05–2 ppm.) of the Na salts of NAA an IAA. With non-pregerminated tubers, the nun bers of young tubers increased considerably higher concentrations (2–8 ppm.) of NAA and IA but their formation was delayed and their yie was decreased.—From author's summary.

204 LUNDEN, A. P. Undersøkelser over fo holdet mellom potetenes spesifikke, vekt deres tørrstoff- og stivelsesinnhold. [**In vestigations on the relation betwee the specific gravity and the dry-matte and starch content of potatoes.**] *Forsk Fors. Landbr.* 1956, **7**, No. 2, 81–107, bibl. English summary. [Fm Crops Inst., Agri Coll., Norway]

During 1937–47, 1356 potato samples representi a large number of varieties grown under vario soil and climatic conditions were tested. Th methods of determining specific gravity, dry matt and starch content are described. The correlatio coefficients for specific gravity with dry matter an starch, respectively, were found to be +0·959 an +0·945 ; the regression equations are give The results for dry matter and starch in relation specific gravity, as obtained by others, are di cussed. The dry-matter content for the sam specific gravity was found to be considerab higher than that found by other workers, but son also found the same result for Norwegian potato The differences in starch content were not great. All investigations have shown that th percentage of non-starch increases with increasi specific gravity. A review is given of precautio which must be considered in using specific gravi to calculate both dry matter and starch.—Fro author's summary.

205 LE TOURNEAU, D. **Amino acids of pota tubers, etiolated sprouts and foliag** *Bot. Gaz.* 1956, **117**, No. 3, 238–42, bibl. illus. [Idaho Agric. Exp. Sta., Mosco Idaho]

The free and combined amino acids of Rus Burbank potato tubers, etiolated sprouts a foliage were determined by paper-chroma graphic methods. Aspartic acid, glutamic ac glutamine, alanine, γ-aminobutyric acid, a valine were the prominent amino acids detect free in tubers, sprouts, and foliage. Asparagi though conspicuous in tubers and sprouts, w present in small quantities in the foliage. Four u known materials reacting with ninhydrin to g blue colours were detected. Valine, the leucin alanine, aspartic acid, glutamic acid, arginine, a lysine were prominent constituents of the ac hydrolized fractions of tubers, sprouts a foliage. Hydroxyproline was detected only sprouts and foliage hydrolysates. Five unkno materials reacted with ninhydrin.—Author's su mary.

206 Odland, T. E. and Sheehan, J. E. **The response of Irish potatoes to different amounts and ratios of nitrogen, phosphoric acid and potash when grown in continuous culture.** *Amer. Potato J.* 1956. **33,** No. 1, 22–7, bibl. 6. [Rhode Island Agric. Exp. Sta., Kingston]

Following experiments with various amounts of NPK fertilizers of different ratios, it was concluded that under continuous culture the ratio should be gradually changed from the customary 1–2–2 to a 2–1–1 fertilizer. An application of 1500–2000 lb. per acre of an 8–12–12 or 10–10–10 or similar fertilizer would probably supply all the necessary nutrients.—G.M.W.

207 Paauw, F. van der, and Ris, J. De betekenis van de kalitoestand voor aardappelen op kleigronden in Noord-Holland. **The significance of the potash status of the soil for potatoes on marine clay soils.** *Versl. Cent. Inst. Landb. Onderz. Wageningen* 1955, No. 61. 6, pp. 75, bibl. 15, illus.

The paper discusses the effect of the potash status of soils and of potash dressings on the starch and protein-content, flavour, cooking quality and disease susceptibility of potatoes.—D.B.

208 Selsjord, I. Gjødslingsforsøk med poteter. **Manurial trials with potatoes.** *Forskn. Fors. Landbr.* 1956, **7,** No. 4, 277–92, bibl. 5, English summary. [State Exp. Sta., Fours, Norway]

Two series of experiments, spread over 5 counties in W. and SW. Norway, in a mostly humid climate, are reported. The first tested, from 1949–54, the application of 7 cartloads of farmyard manure plus respectively 20, 40, 60 and 80 kg. complete fertilizer B per decare. The first, second and third additional fertilizer dressings increased the tuber crop by 75, 72 and 87 kg. per decare, respectively, and the dry-matter yield by 12, 9 and 9 kg. per decare, but the dry-matter content of the tubers dropped with increasing fertilizer dressing, namely, by 0·1%, 0·2% and 0·3%. When the crops were grouped according to whether they were above or below the average, it was found that the response to the 3 higher fertilizer rates was greater in the crops below the average, namely, an increase of 94, 122 and 80 kg. per decare in the tuber crop and of 14, 20 and 11 kg. per decare in the yield of dry-matter, while the increase for crops above the average was 57, 19 and 100 kg. tubers per decare and 9, 11 and 9 kg. dry-matter per decare. The second series tested, in 1950–4, 7 different times of applying nitrogenous fertilizers to potatoes. Calnitro or nitrate of lime or both were used. In all the trials, there was some increase in the tuber- and in the dry-matter-yield by applying some or all of the N a little later during the growth period rather than by giving it all early in the spring, and the greatest increase in dry-matter yield was obtained when one-half of the N was applied in the spring and one-half when earthing up. Nitrate of lime applied when earthing up gave better results than applications of Calnitro. The content of dry-matter in the tubers declined when the application of N was delayed. Comparison in 1950 and 1951 of Kerrs Pink and King George V showed that the latter, a semi-early variety, had a greater positive response to delayed application or to the application of N in more than one dose than the late variety Kerrs Pink. In another two experiments, which compared different times of applying complete fertilizer, there was a heavy decline in yield when the fertilizer was applied late.—From author's summary.

209 Eichinger, A. Die Wichtigkeit des Schwefels im physiologischen Geschehen der Kartoffelpflanze. **[The importance of sulphur in the physiological processes of the potato plant.]** *Z. Acker- u. Pflbau* 1956, **101,** No. 3, 321–34, bibl. 13.

The paper is largely a discussion of the differences between assimilatory starch and reserve starch, the process of conversion of the one to the other, and the role of mineral salts, e.g. the chlorides (hygroscopic) and the sulphates (non-hygroscopic) in this conversion process. The latter act more favourably on polymerization than the former. The findings confirm the value of the practice of manuring with sulphates of potassium and magnesium to obtain high starch yields.—D.B.

210 Johnson, W. A. and others. **Effects of fertilizer and use of magnesium and minor elements on yields and storage quality of potatoes in Baldwin County, Alabama.** *Amer. Potato J.* 1956, **33,** No. 4, 103–12, bibl. 1. [Agric. Exp. Sta., Auburn, Ala.]

211 Letnes, A. and others. Undersøkelser over arbeidsmetoder og arbeidsforbruk ved potethøsting. **[Studies of methods and labour in harvesting potatoes.]** *Forskn. Fors. Landbr.* 1956, **7,** No. 4, 293–315, illus., English summary. [Hveem Res. and Stock Seed Gr. Fm ; Agric. Coll., Norway ; Inst. Agric. Engng. Vollebekk ; Norwegian Inst. Agric. Econ.]

A preliminary report is presented of the studies of four Norwegian Institutes working in co-operation with farmers. The following are some of the findings. Removal of the foliage requires least labour when chemical sprays are used (sodium chlorate alone or mixed with copper sulphate, or arsenic preparations). The tuber crop will be somewhat smaller when the leaves are destroyed

chemically, but the tubers will be less damaged and storage quality will be improved. Other methods of destroying the leaves are by means of a mechanical beater (little labour) and by a mowing machine (more labour). Potatoes can also be lifted without removal of the leaves. Comparison of lifting and picking each row separately and lifting several rows before picking showed the latter method to be labour-saving and to utilize traction power better. Mechanical equipment is considered still not entirely satisfactory.—From authors' summary.

212 Schippers, P. A. **Some factors influencing the keeping quality of potatoes.** *Neth. J. agric. Sci.* 1955, **3,** No. 4, 305–10.

Physiological and microbiological keeping quality are discussed.—D.B.

213 Volbracht, O. and Kuhnke, U. Mechanische Beschädigungen an Kartoffeln. [**Mechanical injury of potatoes.**] *Kartoffelbau* 1956, **7,** No. 4, 74–7; No. 5, 95–8, bibl. 13, illus. [Inst. Landtechnik, Rheinischen Friedrich-Wilhelms Univ., Bonn]

The effects of height and force of tuber fall, of tuber size and weight, and type of substratum on to which the tubers fell on the degree of injury to the potatoes were studied. In nearly all cases the greater the height of fall, the greater was the injury. The degree of injury caused by different substrata was dependent on the height of fall and on the size of the tubers, these two factors acting separately. The dropping of a weight on to the potatoes was also used as a means of determining the influence of the radius of curvature and maturity of tubers, manurial treatment, potato variety, and the length of storage on the degree of injury caused by an increasing force of fall. The results, which are illustrated by graphs, are discussed with reference to their applications in industry and agriculture.—M.P.

214 Ayers, G. W. and Robinson, D. B. **Control of fusarium dry rot of potatoes by seed treatment.** *Amer. Potato J.* 1956, **33,** No. 1, 1–5, bibl. 5. [Canada Dep. Agric., Ottawa, Ontario]

A high degree of control of dry rot in stored potatoes has been obtained by treatment of seed tubers with Semesan-Bel at planting time. Evidence is given that the fungicide destroys much of the seed-borne inoculum that might otherwise develop in the soil and enter the new tubers through wounds contracted during harvesting and grading.—From authors' summary.

215 Bate-Smith, E. C. **Preservation of food with ionizing radiations.** [Contained in] *Rep. Fd Invest. Bd DSIR 1955* 1956, 53–62, 4s.

A batch of potatoes irradiated in April, with a dose sufficient to prevent sprouting (7000 roentgens) proved to be of inferior cooking quality after storage for four months at 10°C. (50°F.); the texture was poor and the sugar content high.—C.L.S.

216 Gooding, E. G. B. and others. **Flavour of dehydrated potatoes made from material treated with tetrachloronitrobenzene.** *J. Sci. Fd Agric.* 1956, **7,** No. 6, 411–16, bibl. 4.

Tests showed that potatoes, treated with TCNB to reduce sprouting during storage, yielded a dehydrated product with a definite 'earthy' taint which increased with the period of storage of the raw potatoes.—From authors' summary.

217 Choudhuri, H. C. **Storage tests for the control of diseases and insect pests.** *Amer. Potato J.* 1956, **33,** No. 1, 6–14, bibl. 9, illus. [Dir. Agric., W. Bengal, Calcutta, India]

Under unrefrigerated conditions, with a temperature range of 80–96°F., pre-treatment of potato tubers with gammexane D·034 and Geigy –33A at 0·6 oz. per 82 lb. significantly controlled the storage loss caused by decay and loss in weight. Sprout-inhibiting chemicals reduced the weight-loss during storage, but failed to control significantly the loss caused by decay.—From author's summary.

218 Gooding, E. G. B. and Hubbard, A. W. **The effect of certain sprout-depressant treatments on sugar accumulation in stored potatoes.** *J. Sci. Fd Agric.* 1956, **7,** No. 9, 574–7, bibl. 11.

Neither maleic hydrazide, as a pre-harvest foliar spray, nor a preparation containing 3% of tetrachloronitrobenzene had any effect on the accumulation of reducing sugars in King Edward potatoes stored under cool conditions.—M.P.

219 Perlasca, G. **Chemical control of sprouting in white potatoes.** *Amer. Potato J.* 1956, **33,** No. 4, 113–33, bibl. 85.

A review is given of literature on the use of IAA, IPC, MH, the methyl ester of alpha-naphthalene-acetic acid, terpineol and alpha-chloronaphthalene, 2,3,5,6-tetrachloronitrobenzene, 2,4-D and 2,4,5-T in the control of sprouting.—G.M.W.

220 Rose, D. H. and Cook, H. T. **Handling, storage, transportation, and utilization of potatoes. A digest of information on the subject published mostly from 1938 to 1948.** *Bibl. Bull. 11. US. Dep. Agric.* 1949, pp. 163, bibl. 632. [Received July, 1956]

SWEET-POTATOES

221 Nettles, V. F. **Sweet potato variety trials in Florida.** *Circ. S-71. Fla Agric. Exp. Sta.* 1954, pp. 8, illus.

Yield trials from 1951–3 showed that Unit No. 1 Porto Rico variety was satisfactory. Goldrush produced similar yields to Unit No. 1 Porto Rico, except in 1952, had good flesh-colour and was wilt-resistant. Earlyport showed promise for early planting.—G.M.W.

222 Togari, Y. and Shirasawa, Y. **Changes of principal components in the sweet-potato plants in the growing period.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1955, **24,** No. 2, 99–102, English summary. [Fac. Agric., Tokyo Univ.]

To elucidate the basic principles for obtaining high yields from sweet potatoes [*Ipomaea batatas*], changes in the essential components of the different organs during growth were studied in the variety Norin No. 10. The N and K percentages in the leaf blade reached a maximum in mid-July. After 20 August, the N-content in the blade and the K-content in the petiole reached a maximum, tuber starch rapidly increased and the main thickening of the root took place. The starch percentage in the leaf-blade became constant after 11 July ; it is thought that assimilated starch was then transferred directly to the tuber.—From summary.

223 MacNair, Vera. **Effects of storage and cooking on carotene and ascorbic acid content of some sweet potatoes grown in northwest Arkansas.** *Bull. 574. Arkansas agric. Exp. Sta.* 1956, pp. 19, bibl. 29.

The varieties Golden Belle and Allgold were analyzed soon after autumn harvest and after 3- and 6-month storage periods under the usual domestic conditions of 60–65°F. (50°F. being ideal). For each analysis, raw and unpeeled baked and boiled roots were used. In autumn, the varieties contained respectively 8 and 19 mg. carotene/100 g. Very little carotene was lost during the first and appreciably more during the second 3 months of storage, but adequate dietary amounts remained. After 6 months, Allgold contained 2·5 times the amounts in other varieties studied. In storage, Golden Belle retained its vitamin C content somewhat better than Allgold, but both varieties remained good sources of ascorbic acid after storage and cooking. The vitamin C content was increased by irrigation.—F.C.

224 Ezell, B. D. and others. **Physiological and biochemical effects of storage humidity on sweet potatoes.** *J. agric. fd Chem.* 1956, **4,** No. 7, 640–4, bibl. 15, illus. [U.S. Dep. Agric., Beltsville, Maryland]

Sweet-potatoes were stored at 60°F. at 70–75%, 80–86% and 95–100% relative humidities, and at 55°F. at 80–85% relative humidity. Orange Little Stem roots were tested after 11-, 18-, and 25-weeks' storage and Yellow Jersey roots were tested after 13-, 20- and 28-weeks. High humidity had little direct effect on increase in carotene and decrease in ascorbic acid, but it reduced loss of weight and internal breakdown. High humidity also increased moisture content but there was no additional decay. There was more internal breakdown and decay at 55°F. than at 60°F. Above 95%, skin discoloration may occur, and the optimum relative humidity would appear to be 85–90%.—G.M.W.

FIBRE CROPS

COTTON

225 Negi, L. S. **Cotton improvement work in the Punjab—a review.** *Indian Cott. Gr. Rev.* 1956, **10,** No. 2, 73–81, bibl. 8, illus.

226 Walhood, V. T. and Counts, B. **Effects of irrigation on the growth and yield of cotton.** *Calif. Agric.* 1955, **9,** No. 7, 8–11, illus. [Calif. Agric. Exp. Sta., Davis]

A preliminary report is given on the effects of irrigation treatments on the growth, flowering and boll setting, of cotton plants in California.—G.M.W.

227 Rakitin, Ju. and others. **[Magnesium chlorate—an effective defoliant of cotton.]** [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1956, **6,** No. 6, 32–5, illus. [Timirjazev Inst. Pl. Physiol.]

Among the new preparations for the removal of cotton leaves, magnesium chlorate is of interest. This substance is non-toxic, soluble in water and can be used in much less quantity than calcium cyanamide for defoliating cotton crops ; for example, 35 kg./200 l./ha. of calcium cyanamide resulted in 55% leaf fall, while 7 kg./200 l./ha. of magnesium chlorate produced 73% leaf fall. In 1955 a study was made on a collective farm in Tadžik SSR with the cotton variety 108-F to determine the effect of different norms of magnesium chlorate on leaf metabolism, a concentration of 30% magnesium chlorate being used. An application of 6–7 kg. magnesium chlorate per ha. lowers the water content of the leaves and restricts photosynthesis and enzyme activity. This lowering of metabolism encourages

the rapid formation of abscission tissue at the base of the petiole and the subsequent leaf fall. With higher doses of magnesium chlorate (9–10 kg./ha.), the disturbance of physiological processes in the leaf lamina is more acute so that the abscission tissue is not formed and the leaf withers but remains attached to the plant. These results were confirmed by data obtained in Kirgiz SSR—M.H.

228 PARDO P., M. Aportaciones al conocimiento de variedades interesantes de algodón para los regadíos aragoneses. [**A contribution to the knowledge of cotton varieties of interest for the irrigated lands of Aragon.**] *Bol. Inst. Invest. agron., Madr.* 1955, **15,** No. 33, 375–422, illus. [Esta. Cult. de los Grandes Regadíos, Zaragoza, Spain]

Four cotton varieties, Esparta, Andalucía, Chirpan and Paymaster, already grown in Aragon, were compared with 4 very early varieties, Plains, Fox, Stoneville 3.202 and Empire imported from the USA. Chirpan and Esparta had been grown for 10 years in Aragon and Paymaster for 3 ; Andalucía is a selection from Esparta. Esparta gave the highest yield of raw cotton per ha. (921 kg.), followed by Andalucía (860 kg.), Chirpan (845 kg.) and Paymaster (714 kg.). The high-quality fibre obtained from the imported varieties did not compensate for their low yields.—E.B.O.

229 GREEN, J. M. and others. **Cotton variety tests 1950-1954.** *Bull. B-454. Okla. agric. Exp. Sta.* 1955, pp. 15. [Agric. Exp. Sta., Oklahoma A. and M. Coll., Stillwater]

Several varieties of cotton were tested at various locations in Oklahoma, as to their suitability for stripper-harvesting or hand-harvesting. Records of pre-harvest losses were kept. For W. Oklahoma, Lankart 57, Lankart 611, Lockett No. 1, Lockett 140, Marv-L-S-Cluster, Northern Star and Parrott were recommended for stripper-harvesting with Lockett 140 and Marv-L-S-Cluster for hand-harvesting ; for E. Oklahoma, Deltapine 15, D and Pl Fox, Empire and Stoneville 62, all of which require hand-harvesting, were recommended.—G.M.W.

230 REVISTA DE INVESTIGACIONES AGRÍCOLAS. BUENOS AIRES. Comportamiento de variedades y nuevas selecciones de algodón en la Argentina en 1950–1953. [**Behaviour of varieties and new selections of cotton in Argentina in 1950-3.**] *Rev. Invest. agríc., B. Aires* 1955, **9,** No. 4, 229–308, bibl. 30.

An account is given of 3 years' trials to test 33 cotton varieties (29 from Argentina and 4 introduced) in various regions of Argentina. The most suitable varieties are given for each of these regions which include both irrigated areas and areas where rainfall is adequate for cotton. In al the trials the Argentinian varieties yielded mor than the imported ones. Where 2 sowing date were tested, the normal sowing dates gave, in gen eral, higher yields than later sowing dates.—E.B.O

231 FRANS, R. E. and others. **Chemical weed control in cotton, soybeans, and corn 1952-1955.** *Rep. Ser. 55. Arkansas agric. Exp Sta.* 1956, pp. 22.

The results of 4 experimental years seem to in dicate that CIPC (8–16 lb./ac.) is the only chemica that can be used satisfactorily for pre-emergenc weed control in cotton. DCMU is promising. I appears that only CIPC (12 lb./ac.) can be safel used for satisfactory weed control in soyabean without sacrificing yields. For weed control i maize, 2,4,5-T (1 lb./ac.) and DCMU (0·5 lb./ac. were best.—From authors' summary.

232 WHITWORTH, J. W. **Controlling bindweed in cotton.** *Bull. 397. New Mexico agric. Exp Sta.* 1955, pp. 11, illus.

In experiments to control bindweed (*Convolvulu arvensis*), the effect of application of chemicals (DN 2,4-D and 2,4,5-TP), hoeing, flaming, cultiva tion and rotation with barley and Sudan grass wer tested alone and in various combinations. Th most satisfactory control was a 1-year rotatio with Sudan grass, combined with cultivation an 0·75 lb. per acre of 2,4-D which gave a 95% re duction of the bindweed. Four flamings in th following year, when cotton was sown, controlle the remaining weed.—G.M.W.

233 SUBRAMANIAN, D. **Role of trace elemen chelation in the Fusarium wilt o cotton.** *Proc. Indian Acad. Sci. Sect. B.* 1956 **43,** No. 6, 302–7, bibl. 10. [Univ. Bot. Lab Madras]

234 MCKINLAY, K. S. **Cotton pest control i the Eastern Province, Tanganyika** *E. Afr. agric. J.* 1956, **22,** No. 1, 20–3 [Colon. Agric. Insect. Res. Unit, Urambo Tanganyika]

A series of experiments at Ilonga Research Statio during 1956 is reported on the use of insecticides t control local cotton pests and on the interactio between time of sowing, amount of insect damag and yield. The best yields were obtained by sow ing the cotton as soon as rainfall made it possibl Whilst loss of all flower buds for the first mont of flowering made only a small difference to th yield, loss over a longer period would make th use of insecticides necessary and profitable. Th two best insecticidal treatments of those teste were a mixture of 1 lb. DDT + 0·25 lb. BHC an endrin at 0·25 lb. applied in 6–12 gal. of wat

per ac. at weekly intervals during the period of insect attack. Time of sowing and quality of cultivation have an overriding effect upon yield.—From author's summary.

235 Johnson, S. P. and Cowley, W. R. **A preliminary study of the effect of low concentrations of phenoxytype growth regulators on early physiological shedding in Deltapine D10, TPSA, cotton : 1. Seed treatment with dusts.** *Agron. J.* 1956, **48,** No. 9, 412–5, bibl. 2, illus. [Texas A. and M. Coll., College Station]

Cotton seeds were treated with 0·25, 0·025, 0·0025 and 0·00025 ppm. of 2,4,5-TP, 2,4-D or 4–CPA as active ingredients of the dust mixtures. Early physiological boll-shedding by the plants was reduced by the treatments especially by 4–CPA. With 0·025 ppm. of 4–CPA the boll retention on the first fruiting branches was 45% as compared with 40% on control plants. However, 2,4-D and 4–CPA at 0·25 ppm. induced leaf malformations and disrupted apical dominance. In the field test, the treatments did not result in loss of yield or adversely affect lint and seed properties.—G.M.W.

236 Goodman, A. **The shedding and flowering responses of X1730A cotton to a single spray application of DDT.** *Emp. Cott. Gr. Rev.* 1956, **33,** No. 3, 206–15, bibl. 10, illus. [Gezira Res. Fm, Wad Medani, Republ. Sudan]

Unsprayed plants did not shed more fruit points than sprayed plants, but the application of DDT to the plants was associated with considerable changes of rate of shedding of buds and bolls. The loss of early buds and bolls was compensated by shedding at reduced shedding rates later in the season. The loss of insect-damaged buds and bolls is also integrated within the general framework of the physiological regulation of shedding.—Author's summary.

237 Bloodworth, M. E. and others. **Some applications of the thermo-electric method for measuring water flow rates in plants.** *Agron. J.* 1956, **48,** No. 5, 222–8, bibl. 20, illus. [Texas Agric. Exp. Sta., Weslaco]

The thermoelectric method used involves the application of local heat to the stem of a plant and the measurement of the time taken for the warmed sap to rise to a predetermined point above that where the heat was applied. This technique was used in a number of experiments with cotton plants, the results of which are reported. In studies on the effect of soil-moisture tension on cotton-fruit drop, where the available soil-moisture content was reduced to 25–30% of the total, accelerated fruit drop set in. High moisture tensions developed in plants held near the wilting point. This tension was released by applying water. Initial water uptake was very rapid, as measured by sap movement rates, but declined again after a period of 0·5 hr. In trials on the effect of irrigation with saline water, it appeared that the thermoelectric technique was of use for measuring the absorption and rate of water movement in plants grown under these conditions. The technique also appeared to have uses for studying the effect of cotton defoliants. The maximum rates of transpiration in cotton appeared to occur when relative humidities were between 42 and 50%, when temperatures ranged from 95 to 100°F., and wind velocities from 1 to 4 m.p.h.—P.J.B.

238 Goodman, V. H. and Wedding, R. T. **The influence of temperature on the respiration of cotton leaf-discs.** *Pl. Physiol.* 1956, **31,** No. 4, 275–8, bibl. 18, illus. [Univ. California, Riverside]

Leaf-discs cut from maturing cotton leaves were used to determine respiration rates at a series of temperatures from 5 to 55°C. It was shown that the rate of respiration increased with temperature up to 45°C. and that at 50°C. and 55°C. there was an initial decrease in the rate of respiration. At temperatures below 25°C. there was some tendency for the respiration rate to increase with time over a 3-hour period and above 30°C. for respiration to decrease with time. At 45 and 50°C. the decrease with time was not as great as at temperatures of 35 and 40°C.—From authors' summary.

239 Hacskaylo, J. and Ergle, D. R. **Effect of schradan on growth and photosynthetic pigments of the cotton plant.** *Bot. Gaz.* 1955, **117,** No. 2, 120–6, bibl. 27, illus. [Texas Agric. Exp. Sta., Coll. Sta.]

Schradan (octamethylpyrophosphoramide) is of value in controlling cotton aphids and spider mites. The effects of the addition of 0, 10, 100, and 1000 ppm. of schradan to cotton plants in nutrient cultures were determined. The 10- and 100-ppm. treatments stimulated vegetative growth, but 1000 ppm. were phytotoxic. All 3 levels, especially the highest, decreased flowering and boll setting. Concentrations of chlorophyll and carotenoids in the leaves increased with increased concentrations of the insecticide.—G.M.W.

240 Jewitt, T. N. **Field nitrates in the Gezira soil. 2.** *J. agric. Sci.* 1956, **47,** Pt. 4, 461–7, bibl. 8. [Res. Div., Minist. Agric., Republ. Sudan]

[See also *Fld Crop Abstr.* 4 : 153.] The yields of cotton from 5 three-course rotations are given ; they show marked seasonal variations, the varia-

tions of the different rotations being in close accord with one another. The average yields of the rotations are related fairly closely to the average soil nitrates ; in individual years this is not so, though considerable responses to N manuring are always obtained on Gezira soil. The distribution of nitrate in this soil is discussed and figures are given showing differences in nitrification in soil from the different rotations. In the 3-course rotation experiments, surface nitrates in August and September in the wider rotation show a strong negative correlation with the rainfall of the period 1 July to 15 August. —From author's summary.

241 Bhat, N. R. and Gopani, D. D. **Manurial experiments on Surti cotton with nitrogenous fertilizers.** *Indian Cott. Gr. Rev.* 1956, **10**, No. 2, 82–93, bibl. 8. [Agric. Res. Sta., Surat] [Received October, 1955]

The response of Surti cotton (*G. herbaceum* var. *weightianum*) to N was better when the manure was drilled or broadcasted 1–1·5 months after sowing than when applied at sowing time. The yield increase of seed cotton due to N was 35–146 lb. Application of N at 40 lb. per acre proved best as the ginning percentage as well as yield was increased. $(NH_4)_2SO_4$ was usually preferable to groundnut cake. Farmyard manure, applied at 10 cart-loads once every 6 years, also gave appreciable increases.—J.F.C.

242 Empire Cotton Growing Corporation. **Progress reports from experiment stations. Season 1954-55. Tanganyika Territory, Eastern Province.** 1956, pp. 14.

Investigations reported :

1. Spacing and time-of-sowing trial, pp. 3–4. As before, cotton sown in February gave a far higher yield than that sown in March, while the April-sown crop gave a negligible yield, as did all plots which were not dusted with 10% DDT and 3% BHC. Spacing at 36 × 12 in. thinned to 1 plant per hole gave the highest yield at all sowing dates.
2. Interplanting trials, pp. 4–5. Cotton interplanted with sorghum, maize and beans yielded much less than a pure stand of cotton.
3. Cultivation trials, pp. 5–6. The advantages, in terms of seed-cotton yields, of early sowing, treating with insecticides and a good cultivation were demonstrated.—M.P.

243 Empire Cotton Growing Corporation. **Progress reports from experiment stations. Season 1954-55. West Indies.** 1956, pp. 22.

Investigations Reported :

1. Manuring and spacing trials, pp. 4–8. Results in Antigua confirmed that useful returns can be obtained from N in seasons of heavy pre-planting or early crop rains, and from moderate applications of P. In several localities, split applications of N, at sowing and when the plants were 5 weeks, were mostly superior to one application at 5 weeks. Spacing trials confirmed the trends shown in the previous year. [*See Fld. Crop Abstr.* 8 : 1001.]
2. Land use, pp. 9–13. At St. Vincent, N increased seed-cotton yields but showed no interaction with the close-season treatments under comparison ; of these, only bare fallow outyielded the control weed fallow. In a second trial, close-season green-manuring gave significantly higher yields of the succeeding cotton than weed fallowing. Early ploughing (4 weeks before sowing) was superior to late ploughing (2 days before sowing). In rotation trials at Antigua, cotton after sugar-cane, grass, and a short-term green manure showed yield increases of 32, 6 and 21% over continuous cotton with a weed fallow. At Monserrat, the superiority of the long-term green manure over the close-season green manure, and bare and weed fallows was noticeable.
3. Variety trials, pp. 13–19. Results were in line with those of the previous year. BAR XL1 again did well at Antigua. In view of the succession of poor cotton seasons in Montserrat, serious consideration is being given to changing the sowing season from February–April to October. Trials indicated however, that the quality of the late-sown cotton was lower than the average for early-grown, Montserrat MSI varieties, and new varieties may be required.
4. Insecticide trials, Antigua, pp. 20–1. Cotton sprayed with endrin at 0·5 lb. a.e. per ac., or toxaphene at 3 lb. per ac. gave the highest yields.
5. Weedicides, Antigua pp. 21–2. JS 16 at 6–18 gal. per ac. suppressed weed growth for 5–6 weeks after sowing the cotton crop, without any ill effects on the early growth of the crop.—M.P.

FLAX

244 Pontoppidan, H. Forsøg med spindhør ved Taastrup Hørskætteri 1954. [**Experiments on fibre-flax at the Taastrup Flax Mill.**] *Lin* 1955, **9**, No. 4, 53–8, English summary.

In 2 trials with the varieties Concurrent, Wiera and Margareta, Wiera gave more scutched flax but somewhat less seed than the 2 others. Concurrent was sown as Dutch seed and as seed from several generations in Denmark ; in both trials the Dutch seed gave the best yield. In trials on sowing rate, 150 kg. (1400 plants per sq. m.) gave the highest yield of scutched flax, while the highest yield of seed and tow was obtained with 190 kg. (1900 plants per sq. m.). Irrigation with 25 mm. at the 8–10 cm. stage gave in 2 trials a very marked yield-increase of both fibre and seed. It is con-

dered that, if water can be supplied, irrigation of ax is economically profitable in Denmark.—rom author's summary.

45 Pontoppidan, H. Forsøg med spindhør ved Taastrup hørskaetteri 1955. **Field trials with fibre flax at Taastrup Flax Mill, 1955.** *Lin* 1956, **10,** No. 1, 4–12, English summary.

arieties are considered as regards yields of utched flax, seed yield and straw-weakness. The utch elite-seed of the variety Wiera gave the ghest yield of scutched flax. In trials on sowing te, an increase from 110 to 190 kg. seed/ha. ised the yield of scutched flax, but lowered the ed-yield ; 170 kg. gave the most economical sult, but 150 kg. is considered best in practice. rigation with 25 mm. bore water increased the eld of scutched flax by 18–49%, and of seed by 4–28%. Risk of lodging was not especially creased by early irrigation, except where there as excess N.—From author's summary.

46 Fröier, K. Svalöfs nya spånadslinsorter och deras praktiska betydelse. **The new Svalöf fibre flax varieties and their practical significance.** *Sverig. Utsädesfören. Tidskr.* 1955, **65,** No. 6, 402–17, bibl. 15, illus., English summary.

he varieties Gerda, Margareta and Kristina, eleased in 1950, are very stiff-strawed and high-elding. Kristina ripens earliest ; Margareta is ie heaviest yielder but rather a late variety and tended only for southernmost Sweden ; while erda is a broad-range variety of remarkably niform yield.—G.M.R.

47 Statens Forsøgsvirksomhed i Plantekultur, Denmark. Forsøg med sorter af spindhør 1953–54. [**Fibre flax varietal trials, 1953-4.**] *Medd. 534. Stat. Forsøgsvirk. Plantekult.* [Contained in] *Tidsskr. Planteavl* 1955, **59,** No. 4, 721–2.

preliminary report is presented on trials with ax varieties. Tabulated information is given, and ie varieties fall into the following order according yield of long-fibre : Wiera (a Dutch variety) ; tofte 356 (Danish) ; Concurrent (Dutch) ; valöf Kristina (Swedish) ; Cascade (American) ; valöf Margareta (Swedish) ; and Liral Sussex rom Lambeg, Northern Ireland).—G.M.R.

48 Frederiksen, P. S. Spindhørfrøs spirehvile. [**Germination tardiness of fibre-flax seed.**] *Lin* 1955, **9,** No. 6, 85–7, English summary. [Dansk Hørforsk. Inst.]

ests with 35 lots of flax seed from the 1949–54 arvests showed that the seed normally has a nsiderable germination-tardiness in the autumn onths. The germination-rate (3 days) and -capacity (7 days) were not optimal until 4 and 3 months after harvest, respectively. There may be a considerable difference in the germination tardiness of seed from different years.—From author's summary.

249 Frederiksen, P. S. Kemisk ukudtsbekaempelse i spindhør. [**The chemical control of weeds in flax.**] *Tidsskr. Planteavl.* 1956, **60,** No. 1, 167–84, bibl. 16, illus., English summary. [Dansk Hørforskningsinst.]

DNC (sodium) and MCPA (sodium) were successfully used as sprays for the control of weeds in flax in 20 field trials made over 4 years. Methods, doses and equipment are described. DNC was more effective when there was no rainfall within 10–15 days after spraying ; MCPA when spraying was immediately followed by fairly copious rainfall. Certain rules for treatment under different climatic conditions were deduced and are presented in Table 6.—G.M.R.

250 Frederiksen, P. S. Kemisk beskyttelse mod hørrust. [**Chemical protection against flax-rust.**] *Lin* 1956, **10,** No. 2, 21–2, bibl. 1, English summary.

In 3 trials carried out with the very susceptible flax variety Concurrent, 0·2% fermasol (containing 74% ferri dimethyl-dithiocarbamate) in 4000 l. of water per ha., was used as the fungicide. When sprayed at the end of the flowering stage, it was able to keep the flax crop almost free from rust (*Melampsora lini*) even under heavy infection. —From author's summary.

251 Holden, D. J. **Factors in dehiscence of the flax fruit.** *Bot. Gaz.* 1956, **117,** No. 4, 294–309, bibl. 33, illus. [Dep. Bot., Univ. Chicago, Illinois]

A study was made of the mechanism of dehiscence of the capsules in three varieties of flax (*Linum usitatissimum*) viz. Punjab 47 (indehiscent), Marine (semidehiscent) and Coimbricum (dehiscent). Observations on anatomy, microchemistry and imbibition are recorded.—G.M.W.

OIL CROPS

RAPE

252 Torssell, B. När inträffade vinterskadorna i höstoljeväxtodlingarna 1955–56 ? Vilka är möjligheterna att motverka liknande skador ? [**When did the winter damage incurred by winter oil-plant cultures in 1955-6 take place ? How is it possible to prevent damage of this nature ?**] *Svensk Frötidn.* 1956, **25,** No. 6–7, 88–93, bibl. 4. [Agric. Coll., Sweden]

Throughout Sweden the two oil-seed crops

generally grown there, winter rape [*Brassica napus* var. *oleifera*] and winter turnip rape [*B. campestris* var. *oleifera*] were severely damaged during the winter of 1955–6, and in some places were a total loss. The dry summer of 1955 accounted for the fact that, especially in Middle Sweden, cultures were poorly developed when winter set in ; but this, though doubtless a contributory factor, could not be entirely responsible because, in many cultures which were well developed due to good local conditions, severe winter damage was also incurred. Within a varietal trial at Mosjö, south of Örebro, a study was made, using a Honeywell-Brown potentiometer, of the temperature at different levels in stands of rape and turnip rape from December to April. The temperatures recorded among the plant stems at 5 cm. and at ground level are shown in a chart in comparison with the minimum air temperatures at a height of 1 m. per day, and the depth of the snow throughout the same period is shown on the same figure. It is seen that the temperature among the plants fell to a critical level (—18° to —20°C. in the rape and —8° to —10°C. in the turnip rape) in December only, when the snow cover was but a few cm. deep. Thereafter the snow cover deepened and furnished protection. Practically all the 9 rape varieties were killed by the winter ; of the 7 winter turnip varieties Grubers I, Rapido II and Grubers II wintered relatively successfully. It is noted that while the temperature in the rape fell to 18–20°C., it never fell below 8°C. in the turnip-rape stand, which in combination with the thin snow cover clearly had a better warmth insulation capacity than the more open and patchy rape stand. A factor contributing to the greater sensitivity of the rape to cold is its greater length of stem. Measures recommended for increasing the reliability of winter rape crops are the choice of suitable varieties, sowing at the right time (the first weeks in August in Middle Sweden and the latter half of August in southern Sweden), moderation in sowing rate, and some form of hilling or earthing up, which last measure is supported by the result of an experiment made in 1954–5.—G.M.R.

253 Torssell, B. Höstoljeväxternas såtidsproblem. [**The problem of when to sow winter oil-plants.**] *Svensk Frötidn.* 1955, **24**, No. 3, 31–8, illus. [Agric. Coll., Sweden]

Two varieties of winter rape [*Brassica napus* var. *oleifera*], Matador and Tenus, and winter turnip-rape [*B. campestris* var. *oleifera*], Storrybs and Rapido II, were sown at Ultuna on the following dates in 1953 : 10 and 14 April, 25 July, 4 and 24 August, 3 and 13 September. When winter set in, records were made of plant height and of leaf-, root- and stem-development. Subsequently the percentage successful wintering was determined and finally the seed yield in the first harvest year. The autumn of 1953 was warmer than usual an so the plants were unusally well developed whe winter set in ; the winter, however, was somewha colder than normal. The curves for seed yiel show rape to give a higher maximum yield tha turnip rape but to be more sensitive to late sowin The optimal sowing date for rape appears to l about 1 August and for turnip rape about 5 Augus The curves for percentage successful winterin show the maximum to be associated with a lat sowing date than is seed yield, whereas the diffe ence between the two plants was least with th sowing date 24 August. The degree of winterhard ness in the two plants is discussed in relation to th records made of differences between them in pla height, percentage leaf, root diameter (marke difference), and stem length (markedly greate in rape), and also in relation to the microclima of the stands, resistance to bacterial attack (i which rape is superior to turnip rape), etc.—G.M.

254 Olsson, G. Vindpollinering hos kor blomstriga oljeväxter. **Wind pollination cruciferous oil plants.** *Sverig. Utsädesföre Tidskr.* 1955, **65**, No. 6, 418–22, bibl. English summary.

The subject was studied in relation to rape, turni rape and white mustard. Object glasses covere with albumen-glycerine were placed at differer distances (1, 5, 20 and 40 m.) from fields of thes crops, and counts of the number of pollen grai per sq. mm. of glass proved that wind-distributio of the pollen of all 3 spp. takes place. For th study of vicinism, sq.-metre plots of white-flowerin white mustard were placed in a field of yellow flowering plants of the same sp., some of the plo being covered by net cages to exclude the large pollen-carrying insects and others left unpro tected. The frequency of vicinists within the cage is considered to be due to wind-carried pollen. It approximately the same as that in the open plot and indicates the importance of wind in pollina tion.—G.M.R.

255 Hellström, N. **Investigations on oi turnips and oil rape. 6. Further in vestigations in chemical composition** *Acta agric. scand.* 1956, **6**, No. 1, 17–44, bib 22, illus. [Roy. Agric. Coll., Uppsala Sweden]

The work is a continuation of that reported i *Fld Crop Abstr.* 8 : 1393 and 1394 on winte hardiness of oil turnip [*Brassica campestris* var *oleifera*] and oil rape [*B. napus* var. *oleifera*] Chemical analyses were made of leaves and root of these species during winter. The conversion o starch to sugar in leaves and roots is a response t low temperature but is brought to an end befor winter sets in. Frost resistance increases as starch content decreases. The changes in the content o

on-reducing sugars, reducing sugars, and soluble itrogen in leaf and root are expressed in a 3-omponent diagram. It is suggested that these three omponents influence the viscosity of the proto-lasm and its hydration and that changes in all ree components [not any one or any two] are volved.—D.B.

56 Andersson, G. and others. Kombinerade sortoch krävegödslingsförsök med höstraps. **Combined variety and nitrogen fertilization trials in winter rape.** *Sverig. Utsädesfören. Tidskr.* 1956, **66,** No. 1, 39–54, bibl. 21, English summary.

rom 1949 to 1954, 5 different doses of calcium itrate (15·5%N), ranging from 400 to 2000 kg. er ha. in 1949 and from 0 to 1600 kg. per ha. in ubsequent years, were applied to the Svalöf arieties of winter rape, namely, Senraps, Tenus nd Matador. Of these varieties Matador is the ost valuable, having the highest yield and oil content. It was found that N applied in autumn may encourage the development of late-sown and weak stands and thus result in better overwintering; but a heavy application of N in autumn to well-developed fields rich in N may have a distinctly negative effect upon overwintering, especially if the autumn is warm. Seed yield was increased by 19% under a 400 kg.-dose per ha., and by 28% under an 800 kg.-dose. Further increases in the dose affected yield only slightly. The application of 800 kg. calcium nitrate or more lowered oil content and resulted in an increased protein content in the seed. Iodine value tends to increase with the dressing of N. Increasing doses of N delay ripening and weaken the stem. Varietal differences in behaviour under N were not marked, although in Matador 1000-grain weight increased significantly with increased dressing while in the other varieties it was unaffected or even slightly reduced. There was also some varietal difference in the effect of increasing doses of N on winterhardiness and oil content.—From authors' summary.

LAND USE, SURVEYS AND MANAGEMENT

57† Sykes, J. D. and Wibberley, G. P. **Profits and problems of farming in south-east England.** *Fm Mgmt. Surv. Rep. 7. Dep. Agric. Econ. Wye Coll.* 1956, pp. 73, illus. study of farming in Kent, Surrey and Sussex uring the 3 years ending 1954–5 is reported.—M.P.

58† Rees, A. M. M. and Howard, R. H. **An economic survey of commercial African farming among the Sala of the Mumbwa district of Northern Rhodesia.** *Agric. Bull. 10. Dep. Agric. N. Rhod.* 1955, pp. 68. [Received Feb., 1956]

59 Johnston, B. F. **Staple food crops in West Africa and the Congo.** *Trop. Agric., Trin.* 1956, **33,** No. 3, 214–20, bibl. 18, illus. [Fd. Res. Inst., Stanford Univ., California]

he present pattern of distribution of the major aple food crops in the area concerned is mapped nd discussed.—M.P.

60 Khan, A. A. and Miller, G. W. **A farm business study of 100 cotton, wheat, sugarcane farms in Montgomery area.** *Pakist. Cott. Bull.* 1956, **4,** No. 8, 29–32.

n economic survey was made of 100 mixed farms pical of the Montgomery area of West Pakistan. he average size of the farms was 12 acres. They ere classified into 3 groups based on the net ersonal income remaining to the cultivator. The analysis revealed the production methods which resulted in the highest net incomes. These methods included the use of 1 acre per farm of guara [*Cyamopsis psoralioides*] as green manure, sowing cotton and wheat in rows, and the use of improved implements.—D.B.

261† Clayton, E. S. **Land use and grain yields in the Kenya Highlands.** *E. Afr. agric. J.* 1956, **22,** No. 1, 32–4, bibl. 2, illus. [Econ. Res. Div., Nairobi]

A brief attempt is made to analyse some of the information contained in the report on the Kenya Agricultural Census, 1954, with particular reference to the rotation relationship in arable farming in the 4 main arable areas of Kenya, i.e. Naivasha, Nakuru, Uasin Gishu and Trans Nzoia. The value of including leys or complementary forage crops in a grain rotation is indicated.—M.P.

262 Loizides, P. A. **The improvement and utilisation of eroded land [in Cyprus].** [Contained in] *UNESCO Symp. Protect. and Conserv. of Nature in the Near East,* Beyrouth, 1954, 124–9. [Dep. Agric., Cyprus]

On shallow eroded soils, yields of wheat, barley and potatoes have been markedly increased by the application of N and P, which gave wheat yields of 10 cwt./ac. or more, the average wheat-yield for Cyprus being 5–6 cwt./ac. Apparently-useless land can be made productive by the use of fertilizers, even though all the top soil and even part of the C horizon have been lost. The inclusion of winter

legumes and grasses in the arable rotation has proved efficient in land improvement ; lucerne can be grown only under irrigation.—J.F.G.

263† Guillemin, R. Évolution de l'agriculture autochtone dans les savanes de l'Oubangui. [**Evolution of autochthonous agriculture in the savannahs of Ubangi-Shari.**] *Agron. trop., Nogent* 1956, **11,** No. 1, 39–61.

The article deals with the geography, soils, vegetation, climate, ethnology and sociology of this region of French Equatorial Africa. Plant succession and the influence of climate on agriculture are considered.—J.F.G.

264† Brammer, H. **Detailed soil survey of the Kpong Pilot Irrigation Area.** *Mem. 1 Gold Cst Dep. Soil Land Use Surv.* 1955, pp. 102, bibl. 43, maps, London ; Crown Agents Oversea Govt. Admin., 27 × 18 cm., 10s. 0d.

FARMING SYSTEMS AND PRACTICES

265 de Wilde, L. O. J. **The organization of native agriculture in the Belgian Congo.** *Neth. J. agric. Sci.* 1956, **4,** No. 3, 223–36, bibl. 3, illus.

Various native agricultural settlement systems are described. Moving strips of cultivated fields are managed in 3 ways : (1) The farmers, occupying adjacent strips permanently, carry out simultaneously deforestation, each stage of the crop rotation, and re-afforestation. (2) Blocks of 1–3 strips are separated by forest and re-allocated each year. (3) There is no individual land allocation and the strips are cultivated mechanically or by collective manual labour.—J.F.G.

266 van Beukering, J. A. **Problems of development in Ceylon.** *Neth. J. agric. Sci.* 1956, **4,** No. 3, 237–47.

A description is given of the structure of native agriculture and of the necessary measures for its development. Rice cultivation, in particular, is described. Increasing the size of holdings and the extension of irrigation and dry farming into the dry zone are discussed.—J.F.G.

267† Bassler, K. Lupinen in den hohen Roggen. [**Lupin (sown) in tall rye.**] *Dtsch. landw. Pr.* 1956, **79,** No. 24, 230–1.

A sowing technique is described to replace the sowing in cereal stubble of lupin used as a green-manure crop before potatoes. The lupin seed is broadcast (at 170 kg. per ha.) into a stand of winter-rye not earlier than 10–12 days before reaping the cereal. By broadcasting 6 m. to right and to left a large area can be sown with little disturbance of the rye stand. Sowing before the rye is harvested gives the lupin a good start and is especially to be recommended for the bitter lupin varieties from Yugoslavia and Italy.—D.B.

268 App, F. and others. **The value of green manure crops in farm practice.** *Bett. Crops* 1956, **50,** No. 3, 16–22 and 41–43, illus. [Seabrook Fmg Corp., Bridgeton, New Jersey]

Green manure as a source of humus has not been much developed owing to a frequent decline in the yield of the subsequent crops. This is ascribed to the manure's N content, which when low causes competition between decomposition bacteria and the following crop. The best green-manure crops are crimson clover [*T. incarnatum*] with ryegrass [*Lolium* sp.], wheat, barley or rye. Ryegrass is the best tilth promoter. It is considered that green-manure crops could eliminate the need to fertilize the following cash-crop, but their value compared with existing methods of soil amelioration has not yet been assessed. In 3 years of an experiment on 2 soils, N has been applied at 60 and 120 lb./acre and through the nodule bacteria of crimson clover to the manure-grasses. The extra N in 120 lb. sometimes caused a decline in dry-matter of the green manure crop, but its quality was always increased. 60 lb. N was sufficient to obtain the necessary quality in one year ; crimson clover was equivalent to this amount. Detailed figures are given on the influence of N on composition of the manure crop and of the soil.—J.F.G.

269† Uhlen, G. Noen langvarige gjødslingsforsøk på Østlandet. **Some long-term manuring experiments in southeastern Norway.** *Forskn. Fors. Landbr.* 1956, **7,** No. 1, 33–79, bibl. 24, English summary. [Agric. Coll. Norway, Inst. Fert. and Soil Mgmt]

Four long-term manuring experiments at Ås in 1939–54 and 2 at Sem in 1939–50 are described. The aim was to determine the effect of N, P and K as fertilizer, when added to dressings of farmyard manure applied at 5–7 tons/decare to potatoes or to other roots. The rotation periods were usually 6 years, with 1 year under row crops, 2 years under cereals and 3 years in ley. Increased yields due to N were evident on all fields, the least effect being obtained from potatoes when the farm manure

was applied at the same time as the N. Yield increases, due to artificial fertilizers, were greatest during the end of the ley period. Increases in yield due to P were larger during the cereal and potato years than during the ley years. K gave increases during the ley period. In most cases there was no need for P and K in addition to farmyard manure to ensure full crops. With the exception of straw and potato haulm, fertilizers produced an increase in N-content. P-content was increased only slightly by manuring, while the K-content in some cases increased considerably.—From author's summary.

270 VAN WYK, S. P. **The economic importance of mechanisation in agriculture [in South Africa].** *Bull. 340.* (*Econ. Ser. 42.*) *Dep. Agric. S. Afr.* 1955, pp. 90, bibl. 15, illus. [Received Aug., 1956]

271 EHRENGRON, V. K. R. Organoleptisch onderzoek naar het zoutgehalte in brak water. **Organoleptic determination of salt concentration in brackish water.** *Surinaam. Landb.* 1956, **4,** No. 1, 16–21, English summary.

The water in the lower reaches of the rivers in Surinam is often used for irrigating rice fields. The farmer usually tastes the water to determine whether or not the salt content is low enough. Tasting trials were carried out on known concentrations of salt in sea water, diluted with distilled water and tap water. It was concluded that tasting often leads to an unreliable judgement of salt content.—From author's summary.

272† MEDICI, M. Sugli indirizzi attuali della pluvirrigazione od irrigazione meccanicamente dosata. [**The present trends of sprinkler irrigation or mechanically-dosed irrigation.**] *Ric. sci.* 1956, **26,** No. 6, 1678–95, bibl. 4, English, French and German summaries.

273† du TOIT, J. S. J. **Rotation under irrigation.** *Fmg in S. Afr.* 1956, **32,** No. 3, 54–6, 73–5, illus. [Vaalhartz Agric. Res. Sta., Andalusia, O.F.S.]

Results obtained in the Vaalhartz Irrigation Scheme have been used in drawing up a table for a 12-year, summer- and winter-cropping programme, suitable for an irrigated small-holding. Fertilizer recommendations are given. Modifications of the system are indicated. Suitable crops include wheat, oats, cotton, peas, groundnuts, green manure and lucerne.—M.P.

274 NEWTON, K. and DROVER, D. P. **The influence of various rotations on coarse-textured soils at Chapman and Wongan Hills Research Stations, Western Australia. 2. Some physical characteristics of the soils.** *J. Soil Sci.* 1956, **7,** No. 2, 226–34, bibl. 16.

The effect of four wheat rotations on the water-stability of the aggregates, organic-C, porosity relations and depth of penetration of a penetrometer is discussed.—From authors' summary.

275† KREUTZ, W. and WALTER, W. Wind- und Strömungsverhältnisse im Bereich von Windschutzanlagen in Abhängigkeit vom Anblaswinkel und praktische Folgerungen — nach Untersuchungen im Windkanal. [**Winds and currents within the protection of windbreaks in relation to the angle at which the wind strikes, and some practical results. Experiments in a wind duct.**] *Z. Acker- u. Pflbau* 1956, **101,** No. 3, 279–90, illus.

This is a physical study of movements of air on the leeside of artificial windbreaks both permeable and impermeable to air. A permeable barrier, e.g. kokos fibre, makes a more efficient windbreak than a non-permeable one, e.g. metal, because, with the former, the angle at which the wind strikes the barrier is of less importance. This is of practical significance because a windbreak must give protection not only against the prevailing wind but also against other injurious winds. The experiments have also shown that, should an impermeable barrier be used, a more efficient protection is obtained if the barrier is raised one-seventh of its total height from the ground.—D.B.

276† WIJK, W. R. van and HIDDING, A. P. Onderzoek over de verandering van het klimaat achter windschermen. [**Investigations into climatic conditions in areas sheltered by wind-breaks.**] *Landbouwk. Tijdschr. Wageningen,* 1955, **67,** 10, 707–12, bibl. 4, illus., English summary.

On the basis of the known correlation between changes in wind velocity and air temperature it was calculated that windbreaks spaced at distances greater than 10 times their height would not cause beneficial changes in air temperature of practical significance for plant growth.—W.J.B.

277 QUEENSLAND DEPARTMENT OF AGRICULTURE. **Crop planting tables.** *Qd agric. J.* 1956, **82,** No. 4, 195–203 ; No. 6, 325–30 ; No. 7, 405–13, illus.

The tables have been compiled for the three main zones of Queensland, viz. the Southern, Central and Northern Districts, and are intended as a general guide. Frost occurrence at various centres is tabulated and information is given on seed weight, germination percentages and plant spacing. Detailed sowing recommendations for a wide range of field crops are given.—M.P.

SOIL AND WATER CONSERVATION

278† Hood, G. W. and Bartholomew, R. P. **Soil and water conservation studies in the Ozark Highlands area of Arkansas.** *Bull. 563. Arkansas agric. Exp. Sta.* 1956, pp. 58, bibl. 4.

279† Free, G. R. **Investigations of tillage for soil and water conservation. 1. A comparison of crop yields for contours vs. up and downslope tillage.** *Proc. Soil Sci. Soc. Amer.* 1956, **20,** No. 3, 427–9, bibl. 4, illus. [Soil Water Conserv. Res. Br., U.S. Dep. Agric., Marcellus, New York]

An experiment consisting of 6 sets of paired plots on a 10% slope of Honeoye silt loam was started in 1942. Management factors such as fertilization, rotation, tillage, and crop were the same for each pair. One plot of each pair, however, was ploughed and planted on the contour and the other up and down hill. Not only did the crop yields differ significantly over the period 1942–54 but the yield advantage in favour of contouring increased. By 1954, the difference calculated from average regression amounted to 21·3%. Reasons for these cumulative benefits of contouring are discussed.—From author's abstract.

280† Norman, A. E. **Farming on the Keyline plan.** *New Commonw.* 1956, **32,** No. 7. 321–4, illus.

Keyline farming is a system invented by Percival Yeomans and widely accepted by Australian farmers. Fertility is developed by using rainfall for irrigation, by better conservation of rain in the soil and by equalisation of water use between the wetter and drier parts by special cultivation procedures. A keyline is a contour or gently sloping line along which the valley slopes begin to level out. Ploughing is carried out parallel to the keyline. On poor, thin soils, a chisel plough is used, successively, to break up the pan and to form an uneven furrow bottom. In the Keyline system, dams are located at the higher points on the valley heads ; valleys are not usually left wooded, nor is steep land ; both can be rendered highly productive.—J.F.G.

281† Hays, O. E. **Factors influencing runoff.** *Agric. Engng, St. Joseph, Mich.* 1955, **36,** No. 11, 732–5, bibl. 1, illus. [Upper Mississippi Valley Conserv. Exp. Sta., U.S. Dep. Agric., East Lansing, Michigan]

Amongst the factors considered in these long-term tests were the effects of soil cover. Stands of bluegrass ((1) protected from grazing and fire and (2) mown), continuous maize, and a rotation of maize, spring grain and 3 years' hay were studied. Winter run-off increased and summer run-off decreased with increasing age of hay stands. Protected bluegrass yielded less run-off than mown bluegrass. The highest amounts of run-off were from the spring grain following maize, and this was reduced by sub-surface tillage with a large field cultivator in place of ploughing, or by the application of barnyard manure. These methods should be used in conjunction with terracing and strip cropping, which were also tested.—G.M.W.

282 Staple, W. J. **Evaporation from soil and vegetation.** *Neth. J. agric. Sci.* 1956, **4,** No. 1, 39–42, bibl. 8, illus. [Soil Res. Lab., Swift Current, Sask., Canada]

Some results of 28 years' measurements of moisture conservation and use in soil tanks and field plots are described. Most of the rainfall received in south-western Saskatchewan is soon returned to the atmosphere by evaporation from bare soil or by transpiration from crops. Only 21% of the precipitation is conserved in summerfallow during the 21–month summerfallow period. Wheat yield is determined largely by the moisture stored in the soil at seeding time and by the subsequent rainfall. Rough estimates of evaporation from soil can be made under semi-arid conditions, such as in south-western Saskatchewan, on the basis of predetermined evaporation curves giving the loss for different soil moisture conditions. Detailed data on capillary conductivity and diffusion coefficients are needed for computing moisture movement through soil to an evaporating surface. —Author's summary.

283† Commission for Technical Co-operation in Africa South of the Sahara. **Bibliography on the use of cover plants in soil conservation.** *Mon. bibl. Bull.* 1956, **6,** No. 4, 5–12, bibl. 90.

The references are grouped under (1) general and theoretical studies, and (2) techniques of application particularly in tropical and sub-tropical countries.—M.P.

284† Commission for Technical Co-operation in Africa South of the Sahara. **List of plants utilized for soil cover and erosion control in the territories of Africa south of the Sahara.** *Mon. bibl. Bull.* 1956, **6,** No. 4, 13–18.

101 trees, shrubs, legumes, grasses and other plants are listed together with their uses and the territories where they are utilized.—M.P.

WEEDS, WEED CONTROL AND WEEDKILLERS

Where weeds are specific to a crop, see under the crop concerned.

85† GRIFFITHS, D. J. and JOHNSTONE, T. D. **Origin of the common wild oat, *Avena fatua* L.** *Nature, Lond.* 1956, **178,** No. 4524, 99–100, bibl. 7, illus. [Welsh Pl. Breed. Sta., Aberystwyth]

86 GRAM, E. **Control of wild oats in Denmark.** *Pl. Prot. Bull. FAO* 1956, **4,** No. 11, 170–1, bibl. 2. [Stat. Plantepat. Forsøg., Lyngby]

Wild oats (*Avena fatua*) have been spreading in Denmark. Where conditions allow the weed to propagate, weeding and suitable rotations are needed to control heavy infestation. The continuous growing of sugar-beet permits mechanical control. On 1 June, 1956, a new Act came into force which requires eradication measures in June–July, statements of the prevalence of wild oats in produce or property to be sold and various provisions for machine disinfection.—J.F.C.

87 SKOK, J. and SCULLY, N. J. **Nature of the photoperiodic responses of buckwheat.** *Bot. Gaz.* 1955, **117,** No. 2, 134–41, bibl. 11, illus. [Argonne Nat. Lab., Lemont, Illinois]

Photoperiod had no effect on floral initiation in tartary buckwheat (*Fagopyrum tataricum*), but it was shown that short photoperiods promoted floral development, fruiting and lateral-shoot production, while long photoperiods promoted elongation of the main axis. By interrupting the dark and light periods, floral development was found to be associated with a dark-dependent mechanism and main-axis elongation with a light-dependent mechanism.—G.M.W.

88 ŠARAPOV, V. I. **[Control of windfall hemp and *Abutilon* with the aid of 2,4-D.]** [Russian] *Zemledelie* (*Agriculture, USSR*) 1956, **4,** No. 5, 120.

Cereal crops following fibre crops often become appreciably infested with plants arising from seed which has been shed by the fibre crop. Applied as a spray at 0·5–0·75 kg./ha., 2,4-D (70–75%) destroyed *Abutilon*, but 1–1·5 kg./ha. were necessary to destroy hemp [*Cannabis* sp.]. Only 0·25 kg./ha. was required to destroy kenaf [*Hibiscus* sp.]—J.F.C.

89† SELLSCHOP, J. and HATTINGH, I. D. **Control of nut-grass on lands in the summer-rainfall areas.** *Fmg in S. Afr.* 1956, **32,** No. 3, 49–52, 77–80, bibl. 7, illus. [Agric. Coll. Potchefstroom, Transvaal]

Measures considered for the control of *Cyperus esculentus* and *C. rotundus* include: deep and thorough soil cultivation; winter ploughing; the sowing of summer crops, such as maize, soya-beans, babala (*Pennisetum typhoideum*) and sunflower, also tall, erect cowpeas, at a denser rate than usual, followed by deep hoeing when the crop has emerged. Winter crops, grasses and lucerne are less effective competitors with the nut-grass. For checking the weed, 2,4-D or MCP at 2–3 lb. a.e. in 40 gal. of water per morgen [1 morgen = 2·116 ac] is recommended for spraying on all crops, a few days after sowing, except sunflowers and babala.—M.P.

290 DAY, B. E. **Status of the nutgrass problem in California.** *Proc. 8th Calif. and 15th West. Weed Contr. Conf.* 1956, 125–9.

Two successive applications of fortified diesel oil may reduce the number of tubers of *Cyperus rotundus* by 50%. 2,4-D is somewhat more effective than MCPA or 2,4,5-T; 2 applications of 2 lb. of the acid formulation per acre giving 60–80% kill of tubers. High rates or the addition of oil give poorer results. Single applications of 2,4-D at up to 400 lb. per acre have failed to give complete control. Tubers of *C. esculentus* are more resistant to desiccation than those of *C. rotundus* and are therefore less readily killed by cultivation. For small-scale fumigation methyl bromide gives the best results, dichloropropane and ethylene dibromide are less effective.—*Weed Abstr.* 5 : 1414.

291† WIESE, A. F. and REA, H. E. **Bindweed control in the Panhandle of Texas.** *Bull. 802. Tex. agric. Exp. Sta.* 1955, pp. 8, bibl. 10, illus. [Amarillo Exp. Sta., Bushland, Texas]

Methods of controlling small and large infestations of field bindweed (*Convolvulus arvensis*) were tested. Soil sterilants, sodium chlorate, concentrated borascu, atlacide, polybor chlorate and karmex W. were effective at 5, 16, 7, 12 and 0·375 lb. per sq. rod (=30·25 sq. yd.), respectively, when followed by rainfall or irrigation. Large-scale infestations were controlled more economically by intensive cultivation with a sweep-type plough at intervals of 3 weeks in dry weather and 2 weeks in wet. Two annual applications of 2,4-D ester at 1 lb. per acre where cultivation was impractical gave 80% control after 3 years. A 2-year cropping system of wheat followed by sweep-cultivated fallow gave 92% control after 3 years.—G.M.W.

292† HELGESON, E. A. **Quackgrass root extract has puzzling effect on seeds of**

crop plants. *Bi-mon. Bull. N. Dak. agric. Exp. Sta.* 1956, **18,** No. 6, 191–2.

Seeds of lucerne, flax and wheat were treated with various concentrations (1 : 10, 1 : 20, 1 : 30 and 1 : 40) of quackgrass-root [*Agropyron repens*] extract in water. The most concentrated extract had little effect, but at lower concentrations root growth increased up to 15% more than the untreated controls.—G.M.W.

293 VENGRIS, J. **Quackgrass control in field corn by pre-planting applications of maleic hydrazide and dalapon.** *Proc. 9th Northeast. Weed Contr. Conf.* 1955, 399–400, bibl. 1. [Massachussets Agric. Exp. Sta., Amherst]

MH and dalapon at 5 and 10 lb. per acre significantly depressed growth of *Agropyron repens* in maize when applied 7 days before sowing. At 10 lb. per acre, dalapon decreased yields of maize. —From *Weed Abstr.* 4 : 777.

294† RANDALL, C. G. **Russian knapweed control.** *Proc. 8th Calif. and 15th West. Weed Contr. Conf.* 1956, 123–5. [California Dep. Agric., Sacramento]

Treatments were applied in autumn when the Russian knapweed [*Centaurea repens*] was at the rosette stage. They consisted of 2,4-D (low volatile ester, amine and emulsive acid) 2,4,5-TP (amine and ester) and 4-CPA at 2,4 and 8 lb. per acre in 80 gal. of water. The effect of volume was also tested using 4 lb. of amine [not stated whether 2,4-D, 2,4,5-TP or both] in 20, 40, 80 and 160 gal. of water. Evaluations made in May after irrigation in March, showed that 8 lb. per acre of 2,4-D (acid and amine) and 8 lb. per acre of 2,4,5-TP (ester) gave an 85% reduction, and other rates and materials gave lower results. In the volume tests, 80 gal. per acre gave an 80% reduction and 160 gal. per acre a 95% reduction. In a further series of experiments 2,4-D was used as a temporary soil sterilant, at 20, 40, 80 and 120 lb. per acre of the amine and acid and 40 and 80 lb. per acre of the ester. The amine and acid gave 90–100% control.—G.M.W.

295 KOEHLER, J. W. **Whitetop.** *Proc. 8th Calif. and 15th West. Weed Contr. Conf.* 1956, 122–3.

The best control of whitetop (*Cardaria draba* and *C. pubescens*) has been obtained by spraying with 2,4-D in the bud stage followed by cultivation after 10–14 days. Without cultivation several applications of 2,4-D are necessary.—*Weed Abstr.* 5 : 1412.

296† STEARNS, F. **The influence of light and temperature on germination and flowering of five species of *Plantago*** *Proc. 12th N. Cent. Weed Contr. Conf.* 1955 8. [Purdue Univ., Lafayette, Indiana]

297 FRAASSEN, A. M. van and WELSENES, Ann M. van. De kiemplanten der tweezaad lobbige akkeronkruiden (2) [**Seedlings o dicotyledenous weeds of arable land Vol. 2.**] *Meded. 71. Dir. Landb Voorl.* 1955 pp. 77, illus., 21 × 15 cm. Dir. LandbVoorl. [The Hague]

This publication supplements the first volume o the same work (Mededeling No. 67). Notes ar given on the ecology and distribution of 96 Dutc weeds, with descriptions of the first 1–5 leaves o each. There are also drawings of the seedlings o each plant described. An index of scientific name is provided.—W.J.B.

298† MATTHEWS, L. J. **Chemical methods o weed control.** *Bull. 329. Dep. Agric. N.Z.* 1956, pp. 100, illus.

Herbicides used in New Zealand are described i detail. The 54 hormone compounds available ar tabulated as regards formulation, trade name acid-equivalent rates, volatility, solubility an plants controlled by them. Lists are given of weed largely controlled by normal rates of hormon weed-killers, phenolic compounds (9 tabulated) TCA (application rates and methods tabulated) dalapon, carbamates (IPC and CIPC), ure compounds, oktone, chlorates, borates and ar senicals. Other chemicals described include MH endothal, anlap-1, nix, ammate, cyanates, CaCN and H_2SO_4. An extensive list is given of weeds an measures for their control. Recommendations fo weed control in specific crops are given. Specia weed problems are considered in a final section.— J.F.C.

299† SANTELMANN, P. W. and WILLARD, C. J **The absorption and translocation o dalapon.** *Proc. 9th Northeast. Weed Contr Conf.* 1955, 21–9, bibl. 6. [Ohio State Univ. Columbus]

300 SCHULTZ, H. B. and others. **Drift of 2,4-I applied by plane.** *Calif. Agric.* 1956, **10** No. 8, 4–5 and 14, illus. [Univ. Calif. Davis.]

301† ANDERSON, E. G. **What weeds cost us i Canada.** *Joint Meet. West. and Calif. Wee Contr. Conf.* 1956, pp. 15.

An attempt is made to calculate the annua financial losses in Canada due to weed infestatio and the additional mechanical operations asso iated with their elimination.—M.H.F.

CROP BOTANY

302† KARJAKIN, A. V. and others. [**The luminescence method of determining viability in crop seeds.**] [Russian] *Doklady Akad. Nauk, SSSR.* (*Proc. Acad. Sci., USSR*) 1956, **106,** No. 4, 739–42, bibl. 4, illus.

The use of ultra-violet light for determining purity in seed samples is shown to be practicable for determining seed viability. For certain crops, treatment of the seed with special solutions is required in order to enhance the colouring effects. For example, a soda solution (1% Na_2CO_3) of acridine orange (concentration 0·0003–0·0005 g./cc.) is required for barley and a water/alcohol solution of rhodamine 6 GDN (concentration 0·00005–0·0001 g./cc.) is required for wheat.—M.H.

303 WEINMANN, I. Untersuchungen zur Samendiagnostik von *Brassica*-Arten und -Sorten unter besonderer Berücksichtigung chemisch-physikalischer Methoden. [**Identification of seed of *Brassica* species and varieties with reference to the physico-chemical methods.**] *Z. Pflzücht.* 1956, **36,** No. 1, 1–30, bibl. 53, illus. [Bundesanst. f. Qualitäts Forsch. Pfl. Erzeugnisse, Geisenheim, Rheingau, W. Germany]

Seeds of *B. napus* and *B. rapa* were distinguished by a modification of Schuphan's rapid chemical method [see *Fld Crop Abstr.* 5 : 173]. Varieties within these species were clearly distinguished by the paper-chromatographic separation of the methanol solution of pigments of the flavone group.—D.B.

304 LEGGETT, J. E. and EPSTEIN, E. **Kinetics of sulfate absorption by barley roots.** *Pl. Physiol.* 1956, **31,** No. 3, 222–6, bibl. 19. [Agric. Res. Serv., Beltsville, Maryland]

A report is given of short-term experiments on the absorption of S^{35}-labelled sulphate by excised barley roots. Rates of absorption were consistent with the view that carriers are involved.—G.M.W.

305† ZILLMANN, K.-H. Beobachtung des Wurzelwachstums in Feldbeständen. [**Observations on root growth in stands of crops.**] *Dtsch. Landw.* 1956, **7,** No 8, 394–400, bibl. 9, illus. [Inst. Acker- u. Pflbau, Humboldt Univ., E. Berlin]

A cabinet which is sunk into the ground for observation of growth in length of roots at regular, short intervals is described. The front wall of the cabinet, fitted with shutters, is oblique so that the emergence of the vertically downward growing roots can be observed. Observations were made in 1954 and 1955 on the root growth of spring barley, oats and potatoes, and of the catch crops spring rape and mustard. Growth in length (depth of the longest root and depth of the lowest level of the dense root mass) was plotted against date, and the resulting graph shows the root growth attained at distinct stages of development of top growth. The effect of soil moisture on root growth was studied by comparing results obtained in 1954 and 1955, years which produced contrasting weather.—D.B.

306† GOEDEWAAGEN, M. A. J. and others. Wortelgroei in gronden, bestaande uit een bovengrond van klei en een ondergrond van zand. [**Root development in soils consisting of a top layer of clay and a sandy subsoil.**] *Versl. landb. Onderz.* 1955, No. 61.7, pp. 137, bibls., illus., English summaries.

Investigations into the root development of grass, cereals and root crops were carried out in 8 districts in the Netherlands where clay soils overlie sand. Root growth decreased gradually with depth but increased suddenly near the clay-sand boundary. There was a sharp diminution in the root mass in the upper layer of the sand. The yield of crops increased with the thickness of the clay up to a maximum value where the clay was 75–100 cm. thick. Both deep ploughing and subsoiling increased crop yields where these were limited by the shallowness of the clay layer. The reasons for the poor root development in sandy subsoils are discussed and it is concluded that the undisturbed sand is unfavourable to root growth because of its compact nature and because it tends to become saturated with water to the exclusion of oxygen.—W.J.B.

307 SCHWABE, W. W. **Effects of natural and artificial light in arctic latitudes on long- and short-day plants as revealed by growth analysis.** *Ann. Bot., Lond.* 1956, **20,** No. 80, 587–622, bibl. 38, illus. [Inst. Pl. Physiol., Imp. Coll. Sci. Technol., London]

The effects on growth and flowering of two short-day and two long-day plants when grown under different conditions of illumination are described. The plants fully investigated were *Kalanchoe blossfeldiana* and *Xanthium pennsylvanicum* and the annual varieties of *Hyoscyamus niger* and *Beta vulgaris*. Wintex barley was among other plants also grown in some selected treatments. The conditions investigated comprised continuous full daylight (24 hr.), full daylight for the whole of the daily photoperiod and full daylight for half the photoperiods, the other half consisting of either daylight reduced by shading or light from incandescent lamps or fluorescent tubes (daylight-matching type), all of the same low intensity. Two lengths of photoperiod were used for each species, one nearly optimal for flowering, the other closer to the critical daylength ; and the order of the low and high light treatments was varied. These factors were combined factorially. Among

other effects, the data revealed that in all four species investigated the adverse effects on over-all growth to be expected from reduction of the daily photoperiod or the intensity of illumination are in fact minimized. This compensation was effected mainly by large increases in leaf areas, even though in all cases half the daily photoperiod consisted of full daylight. The most striking among the effects on flowering was the failure of sugar-beet to bolt when half of its photoperiod (totals of 20 and 14 hr.) consisted of light from fluorescent lamps. The flowering of barley and *Hyoscyamus* was also delayed considerably under these conditions. The deficiency of red in the spectrum of the fluorescent light is believed to have been the cause. By contrast, the flowering of *Iberis*, a crucifer, was not affected.—From author's abstract.

308† KOPETZ, L. M. Gibt es tagneutrale Pflanzen ? [**Are there day-neutral plants**?] *Bodenkultur* 1956, **8**, No. 4, 349–73, bibl. 3, illus. [Hochsch. f. Bodenkultur, Wien, Austria]

The concept of " day-neutrality " is only a relative one. The term describes plants which are so geographically placed that they do not experience their critical photoperiod, whether this is long or short. The term neutral does not mean a transition stage between the reaction to long- and to short-photoperiod.—D.B.

309† WATSON, D. J. **Measurement of photosynthesis in field conditions.** *Landbouwk. Tijdschr.* 1956, **68**, No. 6, 581–9, bibl. 13.

310† PAAUW, F. van der. De plaats van de fotosynthese in het produktieproces. [**The place of photosynthesis in crop production.**] *Landbouwk. Tijdschr.* 1956, **68**, No. 7, 635–46, bibl. 44, illus., English summary.

311† WATSON, D. J. **The physiological limitations of crop yield, and the possibilities of increasing it.** *Landbouwk. Tijdschr.* 1956, **68**, No. 6, 590–3, bibl. 6.

The subject is discussed mainly in relation to Net Assimilation Rate (rate of dry-matter increase per unit leaf area) and Leaf Area Index (the ratio of leaf area to the area of land surface supporting it). —W.J.B.

312 APPLEMAN, D. and PYFROM, H. T. **Changes in catalase activity and other responses induced in plants by red and blue light.** *Pl. Physiol.* 1956, **30**, No. 6, 543–9, bibl. 15, illus. [Univ. California Coll. Agric., Los Angeles]

In etiolated barley and other cereal seedlings, catalase activity is greatly depressed by blue light and elevated by red light. Catalase in beans, peas and clover was increased by irradiation with blue light and decreased by red light. Quantitative changes, due to red or blue light, in the Hill reaction and in ascorbic acid and protein content are reported. The probable significance of catalase in biosynthetic processes is discussed.—From authors' summary.

313† LUNDBLAD, K. Mikroelementforskningens historia i Sverige. **History of researches concerning trace elements in Sweden.** *Medd. 60. Stat. Jordbruksförsök.* 1956, 7–37, bibl. 176 and in text, English summary.

The bibliography is intended to be a list of original Swedish contributions and handbooks.—From author's summary.

314 LUNDBLAD, K. and JOHANSSON, O. Resultat av de senaste årens svenska mikroelementförsök, 1. Försök med Koppar. **Results of Swedish field trials with minor elements in recent years, 1. Trials with copper.** *Medd.* 61. *Stat. Jordbruksförsök,* 1956, 39–90, bibl. 10, English summary.

In 1945, field trials with Cu were begun. The Cu, usually as $CuSO_4$, was applied together with, and in contrast to, B and Mn. The results include the relationship between the effects of a Cu-dressing and the Cu-content of soils and crops. Roots, potatoes and oats were used. It was concluded that Cu is important in Swedish agriculture, deficiencies causing large quantitative and qualitative crop depressions. Cereals proved the most sensitive to Cu-deficiency, roots and pulses being less so, while the yield of potatoes was more often decreased than increased by its application. The need for a Cu-dressing was found to depend on the year, but no correlation with meteorological data was found. Applications of $CuSO_4$ at 50 kg./ha. and adequate incorporation in the soil before sowing, are recommended.—From authors' summary.

315 JOHANSSON, O. and EKMAN, P. Resultat av de senaste årens svenska mikroelementförsök, 2. Försök med mangen. **Results of Swedish field trials with minor elements in recent years, 2. Trials with manganese.** *Medd. 62. Stat. Jordbruksförsök.* 1956, 91–138, bibl. 6, English summary.

It has been found that deficiencies in Mn appear in most parts of Sweden and may cause considerable depressions in yield. Potatoes seem to be the most sensitive to Mn-deficiency, but oats, barley, sugar-beet and rape [*Brassica napus* var. *oleifera*] have also shown considerable responses to Mn. A positive influence on the sugar content of beet resulted from a Mn-application under certain conditions. Applications of $MnSO_4$ at 10 kg./ha.,

before sowing, are recommended, but where fixation of Mn by the soil is expected, spraying seems to be the only efficient method of application.—From authors' summary.

316 Lundblad, K. and others. Resultat av de senaste årens svenska mikroelementförsök, 3. Försök med bor. **Results of Swedish field trials with minor elements in recent years, 3. Trials with boron.** *Medd. 63. Stat. Jordbruksförsök.* 1956, 139–174, bibl. 10, English summary.

In Sweden, B-deficiency has reduced yields and even caused total failures of crops. It has also caused quality deterioration and disease, especially in root crops, e.g. lower sugar content in sugar-beet and inedibility of swedes [*Brassica napus* var. *napobrassica*]. Applications of borax at 15–20 kg./ha., incorporated in the soil before sowing, are recommended.—From authors' summary.

317 Alphen, Th. G. van. Bespuiting met borium op verschillende gewassen. [**Application of boron-containing sprays to various crops.**] *Landbouwk. Tijdschr.* 1955, **67,** No. 11–12, 761–80, bibl. 64.

The literature on the foliar application of borax solutions to various crops is reviewed and discussed.—W.J.B.

318 Baker, J. E. and others. **Effects of boron on the water relations of higher plants.** *Pl. Physiol.* 1956. **31,** No. 2, 89–94, bibl. 28, illus. [N.C. State Coll., Raleigh, N. Carolina]

319† Hofmann, E. Die Anwendung radioaktiver Elemente auf dem Gebiete der Pflanzenernährung. [**The use of radioactive elements in the field of plant nutrition.**] *Bayer. landw. Jahrb.* 1956, **33,** Sonderheft 1, 76–84, bibl. 5, illus. [Techn. Hochsch. München, Weihenstephan, Bavaria]

A report is given of experiments with radioactive sulphur as sulphate ($^{35}SO_4$), and radioactive carbon in cyanamide ($Ca^{14}CN_2$).—D.B.

320† Sauerbeck, D. Erfahrungen bei der Molybdänbestimmung in Böden und Pflanzen mittels der Rhodanidmethode. **Experiences with the determination of molybdenum in soil and plants by the thiocyanate technique.** *Landw. Forsch.* 1956, **9,** No. 2, 106–9, bibl. 13. English summary. [Agric. Chem. Inst., Univ. Bonn]

Refinements are suggested of the classical colorimetric technique for the quantitative determination of total Mo in plant ash, soil and standard solutions by means of thiocyanate and stannous chloride.—From author's summary.

321† Benne, E. J. and Jerrim, Doris M. **Report on molybdenum in plants.** *J. Ass. off. agric. Chem., Wash.* 1956, **39,** No. 2, 412–19, bibl. 15. [Michigan Agric. Exp. Sta., East Lansing]

Methods of estimating the Mo content of plants are reviewed, and a procedure, based on a modified form of that evolved by Dick and Bingley, is described.—P.J.B.

322† Benjaminsen, J. and Jensen, J. En kolorimetrisk metode til bestemmelse of fosforinholdet i planter. [**A colorimetric method for determining the phosphoric-acid content of plants.**] *Tidsskr. Planteavl* 1955, **59,** No. 1, 96–105, bibl. 11, English summary.

Determinations are made by means of the Beckman spectrophotometer in nitric acid medium by the addition of ammonium vanadate and ammonium molybdate. Results obtained by this method and by the Lorenz method as modified by Find Poulsen, are in substantial agreement, but the colorimetric method is considerably faster.—From authors' summary.

MISCELLANEOUS

323† O.E.E.C. **Testing of agricultural seeds moving in international trade.** *Project 223. OEEC.* 1955, pp. 150, illus.

This publication contains technical papers read at the international conference on the rules of the International Seed Testing Association, organized by the Ministry of Agriculture and Fisheries, Great Britain, on behalf of the European Productivity Agency of O.E.E.C., and held in Cambridge from 18 June–3 July, 1954. The following papers were read : (1) Sampling. By C. W. Leggatt, pp. 45–50 ; (2) Purity analysis. By O. L. Justice, pp. 51–8 ; (3) Classification of weed seeds. By C. W. Leggatt, pp. 59–60 ; (4) Procedure for germination tests. By I. Gadd, pp. 61–6 ; (5) Standardization of germination conditions and testing equipment. By A. F. Schoorel, pp. 67–74 ; (6) Procedure for biochemical tests. By H. Germ, pp. 75–8 ; (7) Methods for determination of varietal identity. By E. Hellbo, pp. 87–94 ; (8) Maintenance of varietal identity of seeds in international trade. By A. Kjaer, pp. 95–100 ; (9)

Procedure for moisture testing. By M. G. R. Warner, pp. 101–8 ; (10) Provenance. By E. Frey, pp. 109–122 ; (11) Tolerances, re-tests and issue of international certificates. By C. Stahl and Miss K. Sjelby, pp. 123–8.—G.M.W.

324† Kreyger, J. Resultaten van een bewaaronderzoek onder afsluiting van de lucht met een negental landbouwzaaizaden. [**Results from air-tight storage tests with the seeds of 9 crops.**] *Publ. 67. Droogtech. Lab. Cent. Inst. Landb. Onderz., Wageningen* [n.d.] pp. 13, English summary. [Received May, 1956]

Seed samples of rape, perennial ryegrass, sugar-beet, rye, oats, maize, lupin, peas and broad beans were conditioned to different levels of moisture content and then stored in air-tight containers at different temperatures. To maintain the germinating capacity of these seeds unaltered for at least 600 days, it was found necessary to keep their moisture contents at determined levels which varied with the type of seed and the temperature of storage. These safe moisture contents varied with the seeds from 12 to 23% at 2°C., from 9 to 17% at 12°C., from 8 to 16% at 18°C. and from 6 to 13% at 25°C. —From English summary.

325 Friedrich, J. Getreide-, Hackfrucht- und Futterbau auf süddeutschen Hoch- und Übergangsmooren bei Anwendung von Spurenelementen. [**Cultivation of cereals, root crops and fodder crops on bog peat and mesotrophic peat in South Germany with the aid of minor elements.**] *Bayer. landw. Jahrb.* 1956, **33,** Sonderheft 5, pp. 124, bibl. 90, illus. [Bayer. Landesanstalt für Moorwirtschaft und Landkultur]

Rye is the only crop which can be grown with certainty on the peat-bog soils of the alpine foothills in southern Bavaria. In spite of an ample supply of fertilizers and good cultivation, the barley and potato crops are always a failure, and the oat- and beet-crop yields are so low as to be uneconomic. The crop failures were found to be bound up with a deficiency of minor elements and trials were inaugurated to obtain economic results with these crops by the addition of Cu, B and Mn. The effect of these on crops is described and the recommendations resulting from the trials are given below. Rye can be grown equally well on peat-bog as on mineral soil. Other crops should receive the following amendments in addition to basal manuring : oats, 80–100 kg. $CuSO_4$/ha. ; barley, up to 120 kg. $CuSO_4$/ha. ; potatoes, 20 kg. borax/ha. (Mn is also beneficial but is not as important as B) ; beetroot, 15–20 kg. borax/ha., and, if the land has been recently brought into cultivation, 50–100 kg. $MnSO_4$/ha. By using Thomas slag for the phosphate fertilizer in basal manuring, the land is also enriched with Mn thus obviating the addition of $MnSO_4$. Since the minor elements are given as sulphates, lime should be added to maintain the requisite pH of the soil. —D.B.

326 Stewart, A. B. and Reith, J. W. S. **Fertilizer placement for arable crops.** *Leafl. 3. (N.S.) Dep. Agric. Scot.* 1956, pp. 16, bibl. 29.

The application of fertilizers to cereals, potatoes, sugar-beet, mangels, swedes, turnips, peas and beans, in Scotland, is summarized.—M.P.

327 Evans, A. C. and Wilson, L. R. **Responses to fertilisers under farming conditions in the Southern Province of Tanganyika.** *E. Afr. agric. J.* 1956, **22,** No. 1, 24–6, bibl. 1. [Tanganyika Agric. Corp.]

The responses given on a production farm in Nachingwea, by groundnuts, soyabeans, sorghum and maize to applications of ammonium sulphate and superphosphate are discussed. The effects of the fertilizers varied with soil quality and the crop, but in the majority of cases significant increases in yield were obtained. Financial returns (at 1955 prices) indicated that considerable profits were obtained when significant responses were recorded. —M.P.

328 Singh, K. and Pollard, A. G. **The relationship between soil structure, soil cultivation, nitrogen uptake, and crop growth. 2. Effects of cultivation on aggregation of soil.** *J. Sci. Fd Agric.* 1956, **7,** No. 8, 520–30, bibl. 16. [Agric. Chem. Dep., Imp. Coll. Sci. Technol., London]

The crops studied were swedes and wheat. No significant differences existed between the cultivation treatments in regard to disruption of aggregates or in their stability.—From authors' summary.

329† Harmond, J. E. and Rampton, H. H. **A versatile new experimental thresher.** *Agron. J.* 1956, **48,** No. 9, 424–6, bibl. in text, illus. [Oregon Agric. Exp. Sta., Corvallis]

330 Cunningham, R. H. and Hannah, A. E. **A roller thresher for experimental plot material.** *Canad. J. agric. Sci.* 1956, **36,** No. 3, 208–9, bibl. 1, illus. [Canada Dep. Agric., Winnipeg, Manitoba]

A description is given of a small roller thresher which eliminates both mixing of seeds of different varieties and loss of seed. It also reduces mechanical damage to seed, e.g. trials with flax showed only 4·5% damaged kernels when the roller thresher was used, as compared with 44% damaged kernels when a threshing cylinder was used.—G.M.W

1† FINNEY, D. J. and NISSEN, Ø. **Incomplete determination of a measure of quality in a series of experiments.** *J. agric. Sci.* 1956, **48,** No. 1, 124–8, bibl. 1.

ften the ultimate measure of performance in a ld experiment is the product of a gross weight id a factor relating to quality, as when yield of y matter is determined from gross yield and rcentage dry matter. The factor is usually much s variable than the gross yield, yet relatively oublesome and expensive to determine. Proposals e made for determining the quality factor on ly a fraction of all the experiments of one series id applying the averages to the gross yields of hers in the same series ; formulae and tables lating to the most economic ratio of incom- etely to completely recorded experiments are esented.—From authors' summary.

2† FINNEY, D. J. **The statistician and the planning of field experiments.** *J. R. statist. Soc. Ser. A.* 1956, **119,** Pt. 1, 1–27, bibl. 14.

3† BEHRENS, W. U. Die Eignung verschiedener Feldversuchs- Anordnungen zum Ausgleich der Bodenunterschiede. [**The suitability of different arrangements of field experiments to compensate for variations in soil.**] *Z. Acker- u. Pflbau* 1956, **101,** No. 3, 243–78, bibl. 7, illus.

4† IDIA. Progreso realizado en las investigaciones agrícolas en 1954. [**Progress in agricultural research (in Argentina) in 1954.**] *Idia* 1955, No. 90–2, 1–192, bibl. in text, illus.

5† MILLER, A. A. **The use and misuse of climatic resources.** *Advanc. Sci.* 1956, **13,** No. 50, 56–66.

336 HUTCHINSON, J. and FARBROTHER, H. G. **On the estimation of water losses by evaporation under equatorial conditions.** *Emp. Cott. Gr. Rev.* 1956, **33,** No. 3, 170–90, bibl. 10, illus. [Emp. Cott. Gr. Corp., Namulonge, Uganda]

The Piche-Farbrother wet-paper recorder, the Namulonge open-pan recorder and an Australian open pan were compared in order to obtain a reliable index of evaporation. The studies showed that rainfall records cannot be used to correct the evaporation data from open pans, nor, as is sometimes held, could evaporation on rainy days be disregarded. Heat storage was also found to be important in affecting the pattern of the day and night evaporation from an open pan. For open water surfaces the Namulonge recorder was satisfactory, but it was harder to maintain and less accurate than the Piche-Farbrother recorder which gave more precise and reproducible results and the best index of evaporation in the open. The relations between the Penman estimates and both types of recorder in the open were good. It is recommended that a pair of Piche instruments should be suspended in the open, 2 ft. apart, with their evaporating surfaces 3·5 ft. above the ground, over turf or a mulched surface.—M.P.

337† O.E.E.C. **Agricultural demonstrations. Handbook for agricultural advisers.** 1955, pp. 91, illus.

338 HAUGHS, M. A. and IMPER, A. D. **Crop costs.** *Econ. Rep.* 57. *Enterprise Cost Ser. N. Scot. Coll. Dep. agric. Econ.* 1955. 1956, pp. 9.

The crops costed were oats and turnips.—M.P.

REPORTS

The notes below indicate the main investigations in the port covered, in so far as they concern this journal. Where a separate abstract has been made from a particularly interesting section of a report, this is indicated.

39 **Scotland.** West of Scotland Agricultural College. Annual Report 1955. Auchincruive, pp. 64, bibl. 41.

NVESTIGATIONS REPORTED :

. Oat trials, p. 26. Sun II yielded best ; Pajbrg Rex and Abed Palu were not significantly wer, but Ayr Everest and Lightning were. In the pland trial at Sorn, the yields equalled those at uchincruive, Ayr Everest and Sun II giving milar yields.

3. Plant pathology, p. 38. Consecutive yearly treatments with DD continued to reduce the potato-eelworm population, this year to one-third, the yield increase being 0·94 tons first-early potatoes per acre. Ethylene dibromide reduced the population, but the yield increase was only 0·3 tons per acre. In spraying operations against potato blight, yield loss in the rows damaged by tractor wheels was, for treatments on 15 July and 16 August, 34% and 24%, respectively. In 1955, the late appearance of blight and rainy weather rendered the trial on protectants valueless; home-made Burgundy mixture gave the best control.—J.F.C.

340 **States of Jersey.** Experimental Station,

Howard Davis Farm. Report for 1954. [n.d.] pp. 46. [Received July, 1956]

INVESTIGATIONS REPORTED :

1. Potatoes, pp. 25–6. In 1954, a replicated trial using seed of new, once-grown, and twice-grown early potatoes was laid down. The value of Island-grown seed was very marked, yields at 12 weeks compared to Jersey Royal (at 100) being : new seed 114, once-grown seed 180, twice-grown seed 232. In the maincrop trial 1953–4, the following varieties were grown : Majestic, Orion, Dr. McIntosh, Arran Peak, Ulster Supreme and Conference. Orion alone showed marked resistance to blight.

2. Oats, pp. 13–14. Trials were made of the varieties Blenda, Sun II, Onward and Victory. Due to bird-damage, yields were not calculated, but Sun II was considered likely to have yielded best. Straw breakage in Onward was very bad and some blasting occurred in Blenda. The results of acclimatization showed up very clearly; the local variety, Victory, grew ahead of imported Victory and remained further advanced until harvest.

3. Wheat, pp. 14–15. Square Head Master 13/4 was used as a standard in a varietal trial. The other varieties were Atle, Bersee, Little Joss and Hybrid 46. Most of the required features were found in Square Head Master which yielded very heavily and produced a good yield of straw with good lodging-resistance.—J.F.C.

341 **New Zealand** Department of Agriculture. Annual Report of the Director-General of Agriculture for the year ended 31 March 1956. Wellington, 1956, pp. 178.

1. Seed production, p. 24. The DSIR has released seed of 2 oat varieties i.e. Onward and Milford, an importation with stiff straw. Milford is an alternative to milling varieties subject to lodging.

2. Weedicides etc., pp. 28–30, 35, 37. Endothal and phenol preparations have been effective as desiccants of potatoes.—J.F.C.

342 **Nigeria** Department of Agriculture. Annual Report for the year 1953–54. Part 2. 1956, pp. 53.

INVESTIGATIONS REPORTED :

1. Maize trials in the Southern Region, pp. 31–3. Four varieties gave average increases in yield over local ones of about 50%. However, none of the newer varieties proved consistently better than Tsolo. In early-sown (March) trials, yields were good and Tsolo tended to be the best variety, while in late-sown (end of April) trials, much lower yields were given, with the Bounty varieties at the top.

2. Cowpeas, pp. 33–4. Trials confirmed the superiority of early-August sowing over mid-August and early-September sowings. Mauritius tended to do best at the optimum sowing date an New Era at later sowings. New Era was ver susceptible to eelworm, Mauritius less susceptibl and Machakos partially resistant.

3. Cassava, pp. 34–5. The local selections were sup erior in yields to the bred hybrids and showed con sistency of yield within each variety, with Oloront yielding nearly twice as much as any other variety

4. Insecticidal control of maize stem borers a Ibadan, pp. 47–50. Plant-infestation rates on th early- and late-maize crops were identical. Spray ing with endrin (0·034%) barely increased th yield of the early crop significantly. Aldri (0·032%), dieldrin (0·068%) and endrin signi ficantly increased the yields of late-sown crops, bu no treatment was economical. [For results o investigations carried out in the Northern Regio of Nigeria during 1953–4 see *Fld Crop Abstr.* 8 1516].—M.P.

343 OVERSEAS FOOD CORPORATION. Annua report and statement of accounts for th year ended 31st March, 1955. pp. 183, illus Price 6s. 6d. [Kongwa, Urambo and Nach ingwea, Tanganyika] [Received Sept., 1956]

INVESTIGATIONS REPORTED :

1. Soil conservation, pp. 52–8. The initial metho of clearing on a square-mile system made th planning of a drainage system of terraces im possible and was abandoned. At Kongwa, con servation works were constructed during land clearing when the bush was piled into windrows but these were insufficiently strong to hold th run-off, and breaks and wash occurred. By con tinual realignment of low spots, repairing weak areas in the windrows and exclusion of natural drainage-lines from cultivation, reasonable pro tection against erosion was secured, though no provision was made for the removal of run-off. Until 1949, all clearing in Urambo and Naching wea was carried out on a mile-grid system, but considerable wash had occurred due mainly to clearing of drainage areas. Later, it was possible to divide land into watershed areas, siting the main roads on the ridges and leaving the drainage areas for the disposal of run-off. Owing to lack of soil-structure, high rainfall, and the absence of soil-binding crops, terraces had to be constructed for soil-protection. Owing to unreliable rainfall, the variable-grade terrace was adopted. Owing to size, each field was sub-divided into smaller watershed areas, with access roads and artificial or semi-artificial water-disposal areas. Wherever possible, the natural bush or drainage lines were used for the disposal of storm water ; otherwise, a strip of land perpendicular to the contour was left unploughed for the purpose. The terraces are a combination of broad-based and narrow-ridge type with a broad flat channel and can be converted into a broad-band type after a few seasons.

. Maize, pp. 65–9, 129–33. The highest-yielding ariety was the local medium-early Katambili. Kenya Yellow was the best early type. Orthodox eep-ploughing was superseded by using a ripper hich made possible the maximum absorption of arly rain. At Nachingwea, satisfactory results ere obtained from dry-season ploughing. Maize sown on ridges and ridging and sowing are now one in one operation. Rows 3 ft. apart and plants 18–20 in. apart in the rows gave the best yields. t Kongwa, maize follows groundnuts and is own in early February. At Urambo, some is own directly after the first good rains in late ovember or early December, but requires extra eeding. The rest is sown from mid-December to arly January. At Nachingwea, sowing usually egins in December and is completed by mid-anuary. High-grade super at 100–200 lb./ac. is pplied. At Urambo and Nachingwea (sometimes t Kongwa), $(NH_4)_2SO_4$ at 50–100 lb./ac. pro-uced economic increases. At all 3 places, the eneral effect of applying N and P was that, lone, they caused little or no yield increase, but, ogether, considerable increases. Topdressing with was much better than seed-bed application, and me of application (8–46 days after sowing) did not natter. Annual grasses, the commonest weeds, are emoved by ordinary cultivation or hand-hoeing. Maize-pickers proved unsuitable owing to slowness n steep slopes and premature collapse of plants aused by ants. The grain dries out on the standing lant and the ears are picked straight into bags, r stooking is done at the hard-dough stage and the ars are picked when ripe. At Kongwa, yields on 1 in. of rain were negligible, on 14 in., 200–00 lb./ac. and on 23 in., 2000–2300 lb./ac. At Nachingwea the yields averaged about 1200 lb./ac. nd at Urambo about 900 lb./ac., both varying ess than at Kongwa. Fernoxone was tested as a re- and post-emergence spray for maize. Both reatments, especially the former, gave highly gnificant yield increases.

. Sorghum, pp. 69–71, 134–5. A maize seed-ed suits it, and, because of its drought resistance, orghum can be sown even at the beginning of March ; maize-planters or seed-drills have proved uitable. Sorghum is less liable to lodging when own on the flat. A minimum of 2 ft. between rows or mechanical cultivation, and 4 in. in the rows best. High-grade super (or equivalent) at 50–200 lb./ac. is applied at sowing time, and ometimes, 50 lb./ac. of $(NH_4)_2SO_4$ about 4 weeks fter emergence. At Kongwa, superphosphate often ave increased yields. At Urambo kraal manure ave increases. At Nachingwea, responses to P and were positive but generally low. Hand-hoeing nd -thinning at the 9-in. stage proved advan-ageous. Yields vary considerably, the average eing c. 1200 lb./ac., but yields of 2000 lb./ac. ave been obtained. At Kongwa in 1948, the yields of diverse varieties varied widely. Kalo and Wheatland Milo yielded, respectively, 1420 and 1210 lb./ac., grew uniformly and were well adapted to combining. Medium-tall varieties, such as Dobbs, which was grown extensively in all areas, yielded well. Control of stem borer (*Busseola fusca* and *Chilo zonellus*) is achieved by burning or by ploughing-in residues, but the young caterpillars can be destroyed by DDT or derrisol solution. Maize earworm is controlled by DDT or gammexane. Covered smut is readily controlled by organic-Hg dressings.

4. Millet, p. 72. Golden Millet (*Panicum miliaceum*) and Italian millet (*Setaria italica*) yielded well. Owing to small seed-size, a firm fine seed-bed is needed. At Urambo and Nachingwea sowing with a seed drill at 20 lb./ac. during March proved best. Seed is broadcast or sown in rows not more than 6–7 in. apart so that, when young, the only cultivation possible is by a light drag-harrow, or by hand. Where it follows crops in the same season no fertilizer is required ; otherwise, 150 lb./ac. of single superphosphate and 50 lb./ac. of $(NH_4)_2SO_4$ are given. Combining is satisfactory provided the straw is fairly thick and upright. The average yield of Golden Millet or Foxtail Millet is about 1000 lb./ac., but 2000 lb./ac. can be produced.

5. Rice, pp. 81–2 (at Urambo). The main drainage-lines, being wide and flat-bottomed, were well-suited to rice in wet years, but not in an average, dry year. The local varieties gave satisfactory yields when water was sufficient in December and in March-April. Kahogu is the most extensively used variety and is sown at 50 lb./ac. The worst weeds are sedges (mainly *Cyperus rotundus*). Several deep ploughings weaken the weeds but usually make sowing too late and 2,4-D was unsuccessful ; suitable crop-rotation is considered the best method.

6. Groundnuts, pp. 62–5, 112–27. Natal Common and Valencia were selected for sowing in the Kongwa area, and the long-season spreading-bunch type Mwitunde at Urambo. Natal Common gave high initial yields at Kongwa and Nachingwea, but rosette disease caused total loss at Nachingwea and Urambo. Natal Common was the most consistent high-yielder and best for the Kongwa area, but was less suited to other areas also because it matures before the rains finish. Good, deep ploughing and a loose top soil were primary necessities. Groundnuts require sowing when the soil has been deeply moistened by good rains ; late sowing increases the chance of rosette disease and the rain after the end of January is insufficient for proper maturation and satisfactory lifting. Ridge-sowing is practised to prevent inter-terrace wash and to facilitate lifting ; row-width proved to be of comparatively little importance, but ridge-sowing greatly improved yields. Spacing depends on variety, the standard distance between rows being

3 ft. and between plants 2–3 in. (c. 30,000 plants/ac.). For Natal Common at Urambo and Nachingwea, the highest population tested (87,800 and 36,600 plants/ac.) gave the best yields (1462 and 1558 lb./ac.). Mwitunde gave good yields at an evenly distributed low population, e.g. 1235 lb. at 31,000 plants/ac. Seed of long- and short-season varieties needed to be sown early at 50 lb./ac. ; Natal Common yielded better at Urambo when sown on 2 December than later, and best at Kongwa when sown on 9 Jan. The high seeding-rate allows for up to 50% loss through fungus attack. Placement of fertilizers was about twice as effective as broadcasting. At Kongwa, responses to P were low, at Urambo usually low and at Nachingwea appreciable throughout. Granulated phosphate is applied at 50–100 lb./ac. Two machine- and one hand-cultivation are generally sufficient for weed control and soil loosening. Particularly on moist sandy soils, pulling-out is the most efficient method of harvesting ; otherwise, the groundnut digger is used. Stooking as soon as possible after lifting is essential to avoid losses through termites. The period of harvesting for maximum yield was 12–14 days with long-season varieties and 6–10 days for short-season varieties. Latitude, sowing date and *Cercospora* had a marked effect on the length of growth period of Natal Common ; at Nachingwea, late sowings matured more quickly than early sowings. *Cercospora* hastened maturity by causing extensive leaf-fall. Cu-sprays have partially controlled *Cercospora* at Urambo, while at Kongwa and Nachingwea S-dust gave very good control.

7. Soyabeans, pp. 76–9, 127–8. In the 1948 trials at Kongwa and Urambo, American varieties, grew 6–8 in. high and yielded poorly ; this was attributed to unsuitable day-length. Two Batavian varieties grew 18 in. high and yielded 500 and 840 lb./ac., but are considered promising. The long-season variety Malayan yielded 1637 and 1076 lb./ac. at Urambo and Nachingwea, respectively. Poor results at Urambo and Nachingwea resulted from difficulty of establishment due to soil-capping. The use of a harrow or weeder to break the crust proved dangerous to the seedlings. Yields were also reduced by pod-shattering which occurs before and at harvesting. The short-season variety Dixie, which is prone to shattering, has been grown most to-date. Varieties yielding a maximum 1000 lb./ac. under optimal conditions of sowing and hand harvesting on experimental farms are considered capable of only 500 lb./ac. under production farming. The chief factor governing yields is weather at sowing time. Seed-bed preparation is especially important. A solid foundation 1–2 in. from the surface with loose soil above and beneath is obtained by using a tandem disc-harrow, with the discs set straight, after ploughing. The seed is deposited with a drill or planter onto the firm layer. Early sowing increases the yield, but maturity then occurs in the rainy season an combining becomes very difficult. At Nachingwe and Urambo, sowing in late February gave th best results. Less than 21 in. between rows unsatisfactory for cultivation and 3 in. betwee plants in the rows is best. Seed yielded better sow 1·5 in. deep than at 0·5 in. Soyabean-bacteri cultures and soil transfer gave good results. High grade superphosphate (or equivalent) at 75–15 lb./ac. is applied. The plants are machine-cultivate when they become clearly visible and subseque hand-hoeing may be needed. At Urambo an Nachingwea combining proved unsuitable becau of uneven ripening ; hand pulling or cuttin followed by stooking and combine shelling we introduced.

8. Sunflowers, pp. 136–8. At Kongwa, yields 1200–1300 lb./ac. have been obtained, but in 19 the best yields at Kongwa, Urambo and Nachin wea were, respectively, 236, 721 and 518 lb./a Low yields were due to drought, pests and i efficient pollination. Responses to fertilizer we low or uneconomic. Where bees were numerou unbagged heads set 75–95% of seed, and bagg heads only 10–20%. The percentage of unfertiliz developed seeds varied from 3 to 50. The negati correlation between the percentage of unfertiliz seed and of unfertilized developed seed was ve high. It was concluded that a highly self-pollina ing variety or the introduction of large-scale apicu ture was required.

9. Cotton, p. 138. At Urambo and Kongwa, became immediately evident that pests wou ruin the crop. At Nachingwea, varieties fro Ukiriguru proved more suitable than those fro Ilonga and other regions.

10. Green manure, pp. 138–40. At Uramb yields after velvet bean [*Stizolobium* spp.] wi sunn hemp [*Crotolaria juncea*], *Chloris gayana* a sorghum were compared with those after fallo With or without N, all 3 green manures produc significant increases in the yield of subseque grain at various sowing dates. The green manu alone did not cause yield increases comparab with those given by 2 cwt./ac. $(NH_4)_2SO_4$, b provided protection from erosion. At Nachingwe the green manures gave no yield increases, b with fertilizers after fallow, the yields were mu increased.

11. Fertilizers etc., pp. 140–4. Farmyard manu applied at 10 tons./ac. to maize, had a valuab residual effect on succeeding groundnut yields Urambo ; a residual effect of P on groundnu was obtained when 0·6 cwt./ac. of triple supe phosphate was applied. At Nachingwea, valuab residual effects of P on subsequent groundn crops resulted after groundnuts and after *Sorghu sudanense*. Soil analysis showed that nitrate a cumulation began before sufficient rain fell support annual crops ; early-sown maize w

nought to use it before it was leached. The nergence of sunflower and sorghum seedlings as considerably reduced by $(NH_4)_2SO_4$, but the ffect was partly counteracted by superphosphate. 2. Rainfall, fallowing and crop-rotation, pp. 68–9, 43–4. Long term variation in rainfall has been udied. Part of the rain falls too early or late and unavailable to annual crops. For good crops, ng-season groundnuts required 23 in. in 120 days, aize 21 in. in 100 days and sorghum 17 in. The argin of success for native or mechanized agricul- re was narrow. The benefits of dry farming were own to be obtained by a protective covering of ort-season shallow-rooted grass, which was as ffective as a bare fallow, but extracted as much ater as maize. Water storage was insufficient to roduce a reasonable crop in a low-rainfall year. he climatic conditions produce a very rapid de- mposition of humus, but the influence of grass- ots on the physical condition of the soil, includ- g loosening-up, is considerable although brief. ereals benefited from the N-increase due to roundnuts, and sorghum and maize proved to be itable predecessors to groundnuts. At Naching- ea, legumes are followed by maize in the first ear and sorghum in the second with a fallow metimes following. At Urambo, half of the rable land is left to fallow each year. At Kongwa, e legume is followed by maize, then sorghum nd 2 years' fallow.—J.F.C.

344 **South Africa** Department of Agriculture. Annual Report of the Secretary for Agriculture for the year ended 31st. August, 1955. *Fmg in S. Afr.* 1956, **31**, No. 359, 40–175.

NVESTIGATIONS REPORTED :

. Maize trials, Rietvlei Research Station. By . W. Vorster, p. 81. Maize yields were adversely ffected by weeds, particularly where high rates of and N had been applied. Weed encroachment as most harmful 40–50 days after sowing the aize, i.e. just before tasseling. The depressing ffect of a straw mulch on crop-yields may be vercome by 2 top-dressings, each of 300 lb. mmonium sulphate per morgen [1 morgen= ·116 ac.]. Placing fertilizers directly below the aize rows gave best results, but increasing the aize population above 31,000 plants per morgen ave no additional efficiency in fertilizer utiliza- on.

. Cotton, Barberton Research Station. By P. W. orster, p. 81. The variety A7215 appears to be ery suitable for the region. Broadcast application f a mixture of 800 lb. superphosphate + 400 mmonium sulphate + 100 lb. muriate of potash er morgen, raised seed-cotton yields by 840 lb. er morgen above that from unfertilized plots. lacing the mixture 4 in. deep in the plant row, ave an additional yield increase of 290 lb.

3. Sweet potatoes, by F. G. Anderssen, p. 87. The outstanding variety was 4–95.

4. Crops in the winter-rainfall region. By M. H. Slabber, p. 147. Sterling was the best wheat variety at Elsenburg, and Dromedaris at Langgewens. Jongensklip and Langgewens oat varieties were again best. The linseed variety Klein yielded 9·3 bags at Elsenburg, and Royal yielded 7·2 bags per morgen at Langgewens. The lupin (*L. angustifolius*) varieties Svalofs Borre, Sterkgroeier, S.E. Blou No. 1 and Ligvoet produced the highest green- and seed-yields ; whereas *L. albus* varieties gave the lowest yields owing to their susceptibility to brown spot. Yields of green-matter and seed were higher when lupins, oats and barley were cultivated together, than when grown separately. The best potato varieties included Kennebec, Aquila, Maritta and Voran.

5. Crops in the Karoo and eastern Cape Region. By J. A. van Rensburg, pp. 150–1. Wheat yields in a potato/wheat/maize rotation were higher when the rotation followed a 4-year ley of N.Z. tall fecue, than after a 4-year lucerne ley.

6. Glen College of Agriculture, O.F.S. By I.P.J. du Plessis, p. 155. For optimum grain and stover yields of Boesman maize, a 3 × 1 ft. spacing was best. A 6 × 3 ft. spacing gave lowest yields. Top yielders of 13 varieties tested were Bethlehem topcross and Potchefstroom topcross.

7. Vaalhartz Agricultural Research Station, O.F.S. By I. P. J. du Plessis, pp. 156–7. Optimum row-spacing for cotton was 6 in. Lentils were a better winter green-manure crop than barley. White hybrid maize, irrigated, yielded 88 bags of grain [1 bag = 200 lb.] ; yellow maize varieties and hybrids yielded 60–65 bags per morgen. In a grazing trial with winter cereals, a strong correlation was noted between the number of growing points grazed off and the grain yield reduction after each grazing.

8. Kroonstad Agricultural Research Station. By K. E. W. Penzhorn, p. 165. Wheat sown at 75 and 50 lb. per morgen resulted in a higher bushel weight and greater yield than when sown at 25 lb. Maize sown at 10,000 and 20,000 plants per morgen and kept free from weeds, yielded better in 3 ft.- than in 6 ft.-rows.—M.P.

345 **India.** Departments of Agriculture and Animal Husbandry, U.P. College of Veterinary Science, Mechanised State Farm and Agricultural Engineering Department. Annual Report for 1951–2. Allahabad 1955, pp. 213, bibl. in text.

INVESTIGATIONS REPORTED :

1. Wheat, p. 15. NP 710 has been released as dependable and suited to diverse conditions particularly in Central U.P., and NP 775 for Benares and the hills. NP 720 is promising for the Jhansi

district. The standard varieties like Pb 591 remain unsurpassed by any in the Western districts. Dibbling 3 seeds per hole at 6 in. × 9 in. spacing (*c.* 30 lb./ac.) equalled the 80 lb. rate. Sowing at 2·5 in. depth was superior to 1·5 in. Fallow followed by castor cake (50 lb. N/ac.) was superior to other treatments.

2. Barley, p. 16. The first week in November was the best sowing time. N up to 50 lb./ac. gave increased yields.

3. Potatoes, p. 16. The superiority of large seed over small for yield and freedom from virus was confirmed. Optimum sowing time at Kanpur was late October or early November and for Kausani (hills) the second fortnight of March. Yields were increased by 25 and/or 50 lb. N/ac. at the first and/or second earthing. P in the presence of N and K caused significant yield increases, but when applied alone, tended to depress yields.

4. Oilseeds, p. 17. The groundnut variety, T. 25, is under distribution, and T.9 and 19 proved most promising. The sesame varieties, T.3A, T9, 10 and 15 proved best. Seed of T.10, a high-yielding early variety suitable for the doab and eastern U.P. was distributed. Among varieties of yellow sarson [*Brassica campestris* var.] selections BB1–1B and 4115/2 proved best in varietal trials at Kalyanpur and Raya.

5. Pulses, p. 17. Of the early varieties of *Cajanus cajan* ready for harvest in early December, T1 and T2 were selected. Of the *Phaseolus mungo* varieties, No. 27, 47 and 49 (black-seeded) and 60, 72 and 77 (green-seeded) yielded best. T1 remained the best variety of moong. The T.87 variety of *Cicer arietinum* was outstanding in most of U.P., except in the drier areas of Bundelkhand. T163 has proved the best field pea (*Pisum* sp.) to date and T3 the best variety of lentil.

6. Maize and millet, p. 18. Several maize hybrids from USA, Australia and Canada were tested and T41 was recommended. Some of the hybrids yielded better than the best local varieties but were very late in maturing. US.13 was superior to T41 on the hills but not on the plains. *Panicum crusgalli* T6 and *Setaria italica* T4 were released for distribution.

7. Rice, p. 19. Widely grown, improved varieties include the early Ch4, T138 (Anjana), 136, 21, and N.22 and the late paddy T9, 88 and 100 ; Ch 4 yielded *c.* 35 maunds/ac. [1 maund = 82·3 lb] Chinese strains were better than N21 and T21. Sonkarcha, Dudhadhan and S115 yielded better than N22 under rain-fed conditions. At Tissuhi, 30 July was best for transplanting. Planting 8–12 seedlings per hole, and 6 in. apart, gave the highest yields. At Pachperwa, transplanting on 15 July was best.

8. Cotton, p. 21. The early-maturing strain 35/1 continued to give a high yield and superior-quality fibre at Bulandshahr but a 35/4 × PG/709 segregate yielded significantly better. Of America varieties, M4 yielded best at Bulandshahr an 216F and 100F at Raya and Kalai. At presen 216F is generally recommended. Two substrain from 100F, one from N2 and two from P.An yielded better than Perso-American. Applie to 35/1 at flowering, 60 lb./ac. $(NH_4)_2SO_4$ gav significantly high yields.

9. Other fibre crops, p. 22. The sunn-hem [*Crotolaria juncea*] variety T4 from East Punjab s seed earlier and yielded higher green-matter an total seed than lines of C12 and other new colle tions. T25 produced the highest green-matter fo manure at Bulandshahr ; at Kanpur, a local typ proved superior. In a preliminary trial of Patsa (Mesta), NP5 gave the highest fibre yield and be lustre, but was late-maturing.

10. Fertilizers, pp. 31–2. Phosphate applied nea the root zones significantly increased crop yield on almost all soil types. At Kanpur $(NH_2)_2SO_4$ a 60 lb. N/ac. surpassed farmyard manure at 22 and 200 lb. N/ac. ; P at 100 lb. P_2O_5/ac., deepl placed at the time of burying sanai, followed b 125 lb./ac. at sowing, gave the highest yield increas of wheat. Placement of phosphate in bands throug a funnel behind a U.P. plough gave better yield than broadcasting and placement in furrows wit a Victory plough.

11. Pesticides, pp. 35–44. A table is given of th measures in use against pests and diseases. In th control of *Leptocorisa varicornis* on rice, sprayin with 0·25% BHC or dusting with 5% BHC dus proved most effective. In the control of *Cercospor personata* and *C. arachidicola*, dusting with 16 lb. S/ac at intervals of 10 and 15 days increased the yield o late groundnuts by 40 and 20%, respectively. Use o Bordeaux mixture, perenox and cupravit wit linseed oil at 15-day intervals controlled th disease and increased yields by 15, 20 and 30% respectively. Agrosan GN, spergon, tillex an copper carbonate improved germination. Dressin infected barley with agrosan GN, ceresan an tillex combated stripe. Infection of wheat by ear cockle disease was significantly reduced by soakin and sun-drying in sand for 4 hr.

12. Crop husbandry, p. 45. For the highest per centage survival, the optimum seed-rate of whea in various districts was *c.* 20 seers/ac. [1 seer = 2·06 lb.], which gave yields as good as from 5 seers/ac. Higher seed-rates were needed unde rough tillage, low fertility and late sowing. Th superiority of the 15 to 25-seers rate over the usua 50–80 seers was confirmed. Widely conducte experiments on mixed cropping showed that i mixtures of wheat and *Cicer arietinum*, or of barle and peas, the combined yield was invariabl higher than from either crop alone. The effective ness of different manures in controlling weeds o cropped land, was farmyard manure > $(NH_4)_2SO$ > gypsum > super > no manure. Covering th

ummer-monsoon fallow by short-term legumes ncreased N, suppressed weeds and gave extra rain. Balanced manuring at suitable physiological ages suppressed weeds effectively in most crops specially rice.

3. Nutrient requirements of crops, pp. 45–7. or wheat, 50–125 lb. N/ac., and for rice higher pplications, were optimal. Higher N caused lodg-g and disease, was recovered less, and did not ve an economic residual effect. Application of 7% of the N at sowing and the rest at tillering was est for cereals, excepting rice where application of l at transplanting was best. Heavy application of hosphate, placed 1 in. to the side of the grain, amaged wheat germination, but bands 2 in. away ere safe. Compared with broadcasting, there was o advantage to deeply-rooting long-lived legumes e.g. *Cajanus*), but marked improvement in quick-rowing crops with shallow roots (e.g. peas). The was used more efficiently by crops when placed n bands near the seed. Gypsum, applied with ıper and $(NH_4)_2SO_4$, caused the least lodging nd the highest yield of wheat, rice, potatoes, and egumes. The efficiency of N and P was much ncreased by Ca which promoted N uptake. K was ound necessary at higher levels of N and P on any soils. On heavy clay, 50 lb. S/ac. and 1 lb. /ac. increased the rice yield 2–3 fold, and on light oils 6 lb. Cu and 6 lb. Mo increased the grain ield of moong by 75%. Zn applied with B in-reased the yield of maize and rice. Yields were ncreased by spraying NPK and trace elements on aves of wheat, rice and moong. Almost all anures gave residual increases. Organic N pro-uced larger following crops than inorganic N, nd, in split applications, more than when applied ll at sowing.

4. Increasing fertility, p. 47. The common green anure crops: sanai, dhaincha [*Sesbania aculeata*], obia, moong and urd [*Phaseolus mungo*] were ompared. Sanai fixed 60–80 lb. N/ac. and yielded ver 200 maunds of green matter. Second and ird crops of moong T1 yielded 61–90 lb. N and 0–14 maunds of grain. Mo applied with P and Ca ncreased nodulation, fixation and yield.

5. Water relations, pp. 47–8. Water require-ent per unit of dry matter was reduced by arious fertilizers and by mixed cropping. Heavier ressings of N increased the need for irrigation. a or P, singly or together, reduced irrigation eeds. No irrigation was a greater limiting factor an no N on all soils. Excessive N and irrigation, igh seed-rate and absence of available P, K, and a promoted lodging.

6. Composition of produce, p. 48. N increased e protein content of grain more than did P or Ca. Withholding P was without noticeable effect on N ontent but depressed yield.

7. Irradiation, vernalization and hormones, p. 48–9. Ultraviolet irradiation of water-soaked rice seed for 20 min. increased yield by 80%; infra-red irradiation retarded germination, and, applied for 5 min., caused a yield increase of 145% over the control. Treating pre-soaked germinating wheat in September at 8°, 10° and 12°C. for 67 days increased grain yields by 127, 145 and 50%, respectively, flowering being delayed 14 days by treatment at 8°C. Treatment with temperatures of 30°, 35° and 40°C. for 4 days increased yields by 86, 59 and 45%, respectively, flowering being delayed by 12 and 14 days for treatments at 35° and 40°C. respectively. Pre-sowing treatment of wheat and rice with 3 indolyl acetic acid and 2,4-D (0·1–2 ppm.) for 6–12 hr. increased grain yield by 75%.

18. Photosynthesis and respiration, p. 49. N applied as castor cake and $(NH_4)_2SO_4$ to wheat and rice increased photosynthesis and chlorophyll content, the cake being more efficient. Photosynthesis of wheat flag-leaf at 50–100 lb. N applied as $(NH_4)_2SO_4$ remained almost unchanged, further application up to 500 lb. causing depression. At flowering, maximum respiration occurred at 150 lb. N; at preflowering, N beyond 50 lb. caused depression. Rate and date of N application had a marked effect on wheat photosynthesis; 30 lb. N, at sowing, accelerated it remarkably but reduced respiration. At preflowering, P (20 lb. P_2O_5) increased photosynthesis; apparent assimilation was highest at 60 lb. CaO. At flowering, P and Ca, singly or combined, increased the photosynthesis of the flag leaf. $(NH_4)_2SO_4$ caused a higher root respiration than cake or no manure; for leaves the reverse was true. Root respiration was highest with 60 lb. N applied at sowing. Leaf respiration was highest at 30 lb., followed by 60 lb. piecemeal, no manure and 60 lb. entirely at sowing. S increased root-and leaf-respiration, 30 lb. being optimal; P increased respiration of both when applied with Ca. Differences in dry-matter elaboration, with varying plants, nutrition and seasons, were due more to changes in leaf area than in net assimilation rate.

19. Crop yields, pp. 50–1. The yields of various crops under the most effective treatments and various soil and climatic conditions are tabulated. —J.F.C.

346 **Jamaica** Department of Agriculture. Investigations 1954. *Bull. 54. (N.S.) Dep. Agric. Jamaica.* 1955, pp. 130. [Received June, 1956]

INVESTIGATIONS REPORTED:

1. Rice variety trials, pp. 19–22. The yield of spring-sown Bluebonnet 50 was twice that of the autumn-sown crop, and, with Century Patna 231, which also gave significantly higher yields when sown in the spring, was the most promising variety; neither variety lodged nor shattered.

2. Rice fertilizer trials, p. 23. Applications of N

significantly increased the height of rice at flowering and decreased both the time to flowering and maturity, but the yield increases were not significant. P appeared to reduce the time to flowering.
3. Rice seed-rate trials, pp. 24–5. Bluebonnet 50 yielded better than Fortuna (Dominican Republic) at all seed-rates (80–160 lb. per ac.). When spring-sown, the optimum seed-rate for Bluebonnet 50 was 140 lb. per ac. and when autumn-sown, 100 lb. per ac. The yield of the autumn crop was half that of the spring crop. Fortuna yielded best when sown at 100 lb. per ac., but lodging occurred and was severe at higher seed rates.
4. Pigeon pea variety trials, pp. 27–30. Results indicated that the 9 varieties on trial at Irwin and Orange River fell into three groups.
5. Cassava variety trials, p. 31. Smalling was again the outstanding variety.—M.P.

347 **British Guiana** Department of Agriculture. Annual Report of the Director of Agriculture for the year 1954. Georgetown, 1956, pp. 58.

Rice, pp. 32–5. In fertilizer trials with swamp rice, it was established that the separation of individual plots to prevent plot-to-plot interference was not necessary, provided that the fertilizers were worked under the soil prior to flooding. Cotton, pp.35–6. The Sakel varieties were again most promising followed by African Upland and American Upland varieties, but none appears suitable for sowing in December as a spring crop.—M.P.

348 **Surinam [Dutch Guiana]** Department of Agriculture, Animal Husbandry and Fisheries. Report for 1952. 1955, pp. 108.

INVESTIGATIONS REPORTED :

1. Rice, pp. 32–40. In an irrigation trial the following rice yields were obtained, in kg. per ha. : no irrigation, 4181 ; irrigation of fallow and during growth period, 4426 ; irrigation during growth period only, 4398. Studies of weed growth in rice showed the grasses *Leptochloa scabra, Echinochloa crus-pavonis, E. colonum* and *Ischaemum rugosum* (the last two hardly distinguishable from rice in the early stages) to be the most troublesome weeds in the larger, mechanized cultures ; whereas on small farms, where the grazing of fallow commonly keeps the grasses in check, it is the Cyperaceae, especially *Fimbristylis miliacea*, which do most harm. *Eleocharis* spp. are troublesome in some places only, but then often dominate the whole field. Germination capacity was found to differ in the principal weeds : *Echinochloa cruspavonis* and *E. colonum* germinated very rapidly, *Ischaemum rugosum* exhibited a definite period of dormancy when sown, and it took approximately 3 months for seed of *Cyperus articulatus* to germinate. A germination test was made of a seed sample of the productive variety Skrivimankoti which had been sealed in a glass tube in July 1941. The germination capacity at that time was 99% ; in Novembe 1952 it was still 85%.
2. Cereals, pp. 40–1. A preliminary trial of varieties of sorghum developed badly and un evenly, but from the varieties Egyptian Whea and Milo Martin a yield of approximately 14 kg per are was obtained. Tests of *Pennisetum glaucu* began during the year, some varieties being intro duced from Nigeria.
3. Groundnuts, pp. 41–4. An experiment in pre emergence treatment with Dow-premerg (dinitro-ortho-sec. butylphenol) for weed contro in groundnut sowings was very successful. Of varieties already under trial, Mafjan yielde significantly higher than Schwarz 21, Brol, o Gadjah.
4. Soyabeans, pp. 44–5. A trial plot on clay sown in December 1951, yielded only 630 kg. see per ha. Another trial was planted in sandy soil i January 1952 ; from the best part 1660 kg. see per ha. were obtained, a poorer section givin 875 kg. per ha. The last-named plot was treate at different times, after sowing with Dow premerg at the rate of 12·5 l. in 800 l. water per ha. for th control of weed growth. Emergence of the soya bean in the untreated plots was 84% ; wit spraying respectively 0, 1 and 2 days after sowing the percentages were 79, 74 and 68. Varieta selection. Of 14 varieties from the USA, onl Acadian and Palmetto exhibited satisfactor growth and yield. In a preliminary trial of 5 Indon esian varieties, Lawoe and No. 27 were more pro ductive than Soembing.
5. Cassava, p. 47. A study of tuber flavou showed that in some cases the flavour change considerably during the growth period.
6. Fibre plants, p. 59. In a trial of *Corchoru capsularis* 18 and 104, vigorous growth was ex hibited in spite of insect and fungous attack seed was obtained at the end of December. *olotorius* 84 gave lower, very oblique growth an seeded earlier.—G.M.R.

349 **Netherlands.** Centraal Instituut voo Landbouwkundig Onderzoek, Verslag ove 1954. [Report of the Central Institute o Agricultural Research for 1954.] Wagen ingen, 1955, pp. 271, English summaries.

INVESTIGATIONS REPORTED :

1. Preliminary studies of correlation between th growth rhythm of oats and weed vegetation. B Miss E. M. Zeiler, pp. 60–4.
2. Yields obtainable by sprinkler irrigation o sandy soils. By C. Baars, pp. 132–7. Sprinklin on the sandy soils susceptible to drought resulte in yields of cereals and root crops equal to thos from unirrigated sandy soils not susceptible t drought.
3. Response of oats to length of day. By W. H van Dobben and Miss A. C. Wiersema, pp. 164–6

Response of peas to length of day. By P. iepma Wzn, pp. 166–71.

Response of maize to length of day. By W. R. ecker, pp. 171–6.

Influence of intensity of supplementary light experiments on photoperiodism. By Miss A. C. Viersema, pp. 181–7. Minimum light intensities lowing optimum photoperiodic reaction in ereals, peas, flax and poppy were determined.

Field drying of peas. By P. Riepma Wzn, p. 199–207. Three types of tripod were compared nd conclusions were reached on the type of ipod required and the way it should be loaded.

Retention of sprays by plants. By P. Riepma zn, pp. 210–14. An electrometric method of easuring spray retention by plants is described.

Variety trials and cultivation experiments ith linseed in 1953 and 1954. By J. C. Friederich, p. 214–19. The highest yield and the highest oil-ontent in the seed was given by the French ariety Pastel. There were no significant differ-nces in seed production from linseed sown at 40, 0 and 80 kg. per ha. (35–70 lb. per ac.). MCPA nd DNBP gave good control of weeds. The highest yields were obtained when the use of these herbicides was combined with hoeing.—W.J.B.

350 **Colorado** Agricultural Experiment Station. 66th Annual Report. Results of Research in 1952–3. [n.d.] pp. 47. [Received Sept., 1956]

Investigations Reported :

1. Lucerne, p. 2. Lucerne in the rotation increased crop yields.
2. Sorghum, p. 2. Highest sorghum-grain yields were obtained from Early-Early Hegari, Feterita, Coes and Early Hegari.
3. Sweet-corn, p. 14. Iochief and Carmelcross hybrids yielded best in trials.
4. Potatoes, pp. 14–15, 23. Burbank and Triumph varieties planted on 28 April outyielded those planted on 26 May. Applications of 2,4-D and MH proved useful in treating store potatoes.
5. Corn earworm, p. 20. DDT was the most promising insecticide when applied twice within 4 days just as the maize silks appeared.—G.M.W.

BOOKS

51† Biasutti Owen, Emilia. **The storage of seeds for maintenance of viability.** *Bull. 43. Commonw. Bur. Pastures Fld Crops* 1956, pp. 81, bibl. 373, Farnham Royal ; Commonw. Agric. Bur. 20s. or $2·80.

his bulletin is intended to be a guide, primarily r plant breeders, in the development of techiques for the storage of valuable seed stocks. The rvey covers seed longevity—mainly in field, asture and horticultural crops.

Although the holding of seed in a sound ondition over a period of years has been a subject f considerable importance since the early cenuries of crop husbandry, comparatively little ritical work has been undertaken on seed longevity efore this century ; in eleven pages of references ited in this book, only three references are dated efore 1900. The work has been conveniently rranged in ten chapters ; the first brings together examples of authentic records where it is laimed that life had survived for long periods of ime in seeds of various species ; for example, by sing a technique involving the radio-active carbon nethod, it has been estimated that life in some eeds had survived 1040± 210 years. In the next hapter it is shown how the condition of seeds at arvest time, the moisture content, relative umidity, hermetic storage, temperature, storage as and the severity of threshing or hulling affect iability in storage.

The specific differences in the interactions between the relative humidity of the atmosphere and the equilibrium moisture content of the seed of various species, drying temperatures, and the different methods of drying are given the prominence they deserve. In the discussions on the significance of dormancy and the biological activities (including fungal development) proceeding contemporaneously with deterioration in vitality, we find useful guidance for establishing suitable conditions designed to extend the life span of seeds. The data obtained on the effects of fungicides, insecticides, herbicides and various prophylactic treatments on seed longevity extend our knowledge on the proper use of storage accommodation.

A valuable contribution is made by T. Ashton in the review of literature on the inheritance of longevity and the genetical effects of seed treatments and storage conditions. These effects may be considerably more serious than seed injury ascertained by germination tests.

Finally the present knowledge on seed longevity and storage is summarized on the basis of groups of related species, and also in tabular form arranged alphabetically according to species. This book, confined to the subject of storage, is the only one of its kind ; as a digest of world literature it is most valuable. Although it is not claimed to be completely exhaustive, it covers the whole range of

research in a competent manner. The realization of the many obvious gaps in our knowledge of the optimum conditions for maintaining viability in many kinds of seeds should stimulate intensive research in this field. In addition to plant breeders there are others, including seedsmen, seed growers, and husbandry technicians, who should find in this work a wealth of information and guidance in their approach to the problem of seed storage.—Gwilym Evans.

352 Hill, J. F. R. and Moffett, J. P. **Tanganyika. A review of its resources and their development.** 1955, pp. xviii + 924, bibl. 185, maps, Tanganyika Govt., 25 × 16 cm.

This is an outstanding publication and a valuable work of reference. It is in ten parts and Part 6, entitled " Production : economic resources of the territory", contains a long section on agriculture in Tanganyika, pp. 353–553.

In many parts of the Territory, lack of water is said to be the limiting factor to progress and development. In more arid zones, rainfall permits the maturation of fodder- and short-term arable crops but surface reserves of water are inadequate for permanent habitation. In less arid localities, past mis-management has caused serious soil erosion and attention is now focussed on preventive and ameliorative measures. The Soil Conservation Service handles these problems and evaluates the comparative efficiencies of different practices. It also promotes pilot schemes for developing balanced systems of land usage.

Each of the crops grown in Tanganyika is reviewed in turn and measures for controlling pests and diseases and vermin are discussed. Experience is accumulating on mechanization in African agriculture, but the pattern of future development cannot be prophesied. A summary is given of the marketing and price structures and how finance can be provided for agriculture (the Land Bank for non-native farmers and the Local Development Loan Fund for Africans).

Appendix A lists existing legislation relating to agriculture while Appendix B presents the aims and achievements of nine local development schemes for assisting African agriculture, the revised programme of the Overseas Food Corporation and the functioning of the Department of Grain Storage.—M. H. French.

353 Papadakis, J. **Agricultural geography of the world. (Climate, growth rate and rhythm, vegetation, soils, crops, agricultural regions.)** 1952, pp. x + 131, 3 illus., 26 × 18 cm. [Pl. Breed. Inst., Salonika, Greece] [Received Oct. 1955]

In this work the author presents an informative textbook, having as its first part a general discussion of environmental factors in their influence on plants, of crops in relation to environment, of climates with special reference to crop growing of natural vegetation and of soil formation. In the second part, 98 representative agricultural regions of the world are briefly described, the climates being coded in accordance with the author's own system of classification [see pp. 31–42 and *Fld Crop Abstr.* 6 : 1177]. English is not the author's mother tongue, but apart from a few misprints there is little to confuse the reader except the unfortunate use of the word " winterhardiness" instead of the term " severity of the winter " or " winter cold." Useful maps, which may be obtained separately, illustrate the agricultural climates of the world, plant growth-rate and rhythm, the natural vegetation of the world and world soil distribution.—G. M. Roseveare.

354 Papadakis, J. Ecología de los cultivos. **[Crop ecology. Volumes 1 and 2.]** 1954, pp. xvi + 222 and xv + 461, bibl. 255 and 680, illus., Buenos Aires ; Minist. of Agric., Anim. Husb. 26 × 18 cm. [Pl. Breed. Inst., Salonika, Greece] [Received May, 1955]

This work, written originally in English, has been translated into Spanish by Ing. A. Soriano. Vol. 1 deals with ecology generally or the influence of environmental factors upon plant and especially crop-plant growth, and presents a very much enlarged and documented version of the first part of the author's *Agricultural Geography of the World* [see Abs. 353]. In addition there is a chapter (pp. 142–82) on social behaviour, the excretion of root toxins, competition, and the influence of the biotic factor. In both this and Vol. 2, which deals with special ecology or that of the individual crop plants, findings are based on a fully documented discussion of experimental work from all parts of the world, much of it the author's own. The crops treated in Vol. 2 are classified and include practically all crop plants, both horticultural and plantation, although the section on the extremely complex nature of grasslands and some of the forage perennials (Chap. 7, pp. 230–58) is necessarily a brief account. The work is well printed and indexed.—G. M. Roseveare.

355† Annual Reviews Inc. **Annual review of plant physiology.** 1956, Vol. 7, pp. 456.

Among papers in this volume are the following : Mineral nutrition of plants : mechanisms of uptake and transport. By E. Epstein, pp. 1–24, bibl. 126 ; Iron chlorosis. By J. C. Brown, pp. 171–90, bibl. 104 ; Plant proteins. By C. E. Danielson, pp. 215–36, bibl. 64 ; Physiology of root elongation. By J. G. Torrie, pp. 237–66, bibl. 149 ; Mechanisms of carbohydrate breakdown in plants. By B. Axelrod and H. Beevers, pp. 267–98, bibl. 149 ; Physiology of seed germination. By E. H.

Toole and others, pp. 299–324, bibl. 183 ; Absorption and translocation of plant regulators. By J. van Overbeek, pp. 355–72, bibl. 125 ; Effects of light quality on plant growth. By E. C. Wassink and J. A. J. Stolwijk, pp. 373-400, bibl. 87 ; Recent advances in plant physiology in the USSR. By A. L. Kursanov, pp. 401–436, bibl. 400.—J.F.C.

356 LEVITT, J. **The hardiness of plants. Vol. 6 of Agronomy.** 1956, pp. viii + 278, pp. 230–74, illus., London ; Academic Books Ltd. 23 × 15 cm.

The hardiness of plants exposed to high or low temperatures or to drought is of great importance to all concerned with crop production or the growing of plants for pleasure. It is therefore surprising to read in the preface to this book that Professor Levitt has discerned " a waning interest in the subject", and, indeed, a perusal of the extensive bibliography confirms that physiologists during the last fifteen years or so have not given it due attention. World food supplies are long likely to remain inadequate, and, as control of crop environment is often impossible, expensive or difficult for political or social reasons, all contributions to our knowledge of the factors favouring tolerance to extremes of temperature or drought merit the closest attention.

Professor Levitt's book is a notable and welcome contribution to this subject and collates in a condensed manner a wide array of facts and observations concerning the problems of hardiness. About three-fifths of the book concerns low-temperature hardiness and the remainder is nearly equally divided between discussion of hardiness to high temperatures and drought. Problems reviewed include : the elucidation of the physiological bases of different types of injury by unfavourable temperatures or drought ; quantitative methods for expressing the degree of hardiness ; classification of plants in accordance with various factors associated with hardiness ; determination of the critical exposure conditions for injury ; the relationships between tolerance and such factors as developmental stage, nutrition, cell composition, conditioning, water content or enzyme activity. Possible correlations between hardiness to different environmental factors and the distinctions between frost injury and that due to chilling and to frost dehydration are also discussed.

The reader is soon impressed, however, by the contradictory nature of many of the observations and conclusions regarding these basic problems and it is clear that a great deal of detailed research will be required to elucidate them. Professor Levitt's book not only stimulates many ideas and reveals many interesting problems but also provides the intending investigator with an invaluable digest and guide to the relevant literature.

The attempt in Chapter 14 to present a rational hypothesis to explain the more consistent facts regarding freezing injury and hardiness and the mechanisms involved is especially welcome. It is followed up by a useful discussion of physical measurements involved in testing these theories experimentally.

As it is to be hoped that Professor Levitt's efforts will stimulate much further research that will lead in due course to a second edition, some comments on presentation seem warranted. Some passages require re-reading before their significance is understood and in some the meaning remains ambiguous or obscure. The discussion on the definition of frost hardiness, p. 46, and its relationship to the frost-killing point, the relationships with vernalization, p. 56, and the changes in pectin content, or in hardiness, of raspberry plants, p. 89, are examples. There are also a few misprints. The very brief Chapter 6 on " The measurement and meaning of frost hardiness " could well be combined with that most important Chapter 15 on protoplasmal and non-protoplasmal factors in hardiness. The single paragraph on genetic aspects of hardiness seems misplaced at the end of Chapter 6. Chapter 12 on miscellaneous factors and Chapter 11 on cell-sap concentration, together with the section on mineral nutrition in Chapter 7 surely require to be more closely knit together.

These points, however, do not significantly detract from the high intrinsic worth of the book. It merits reading by plant physiologists generally and will be indispensable to all concerned with the problems implicit in the urgent need to learn how to produce plants with greater tolerance to unfavourable environments.—E. J. Hewitt.

357† GARDNER, C. A. and BENNETTS, H. W. **The toxic plants of Western Australia.** 1956, pp. xxix + 259, bibl., illus., Perth ; W. Austr. Newspapers Ltd., 25·5 × 19 cm., 50s.

It is rare for an enthusiastic systematic botanist to team with an equally keen veterinary pathologist in writing a book. Such an unusual combination adds particular authority to the publication of this extremely interesting and economically important information concerning plant toxicity.

The personal observations of the two authors over the past thirty years are collated with the data of others into the first systematic account of the known toxic properties of Western Australian plants. Whilst preserving the accuracy required from scientists, the aim throughout has been to describe the plants in a manner which permits their recognition by non-botanists and particularly by practical farmers. The usefulness of this publication for the latter purpose is greatly assisted by 37 excellent water-colour drawings by Edgar Dell, supplemented by 16 attractive paintings and 45

line-drawings by one of the authors (C.A.G.). It can confidently be anticipated that this book will achieve the aims of its authors, namely, to provide a sound basis for the future development of a more comprehensive treatise.

The variety and wide distribution of many highly toxic species in Western Australia constitute a serious obstacle to fuller development of its pastoral areas. The existing lack of knowledge of the chemical nature of the substances causing this toxicity offers a stimulating challenge to chemists and pharmacologists.

A summary is given of certain plant and animal factors which influence toxicity, followed by a general discussion of cyanogenetic plants and of those inducing photosensitivity.

The bulk of the text deals with the toxic properties of plant species. Although the formal plan varies, each plant family is discussed in terms which include historical and general information, morphological features and specific toxicological symptoms of the locally-occurring and related genera. More detailed botanical descriptions of particular local species are given, together with a more specific elaboration of such toxic symptoms as have been recorded. These are followed by descriptive observations of the characteristic changes noted at postmortem examinations.

Appendix I lists the toxic plants in each district of Western Australia so that farmers, confronted with cases of suspected poisoning, may compare the particular symptoms with those recorded for the various plants in their own areas. Reference to the illustrations should then permit the suspected species to be identified or recognised. Appendices II and III name plants possessing cyanogenetic or photosensitising properties, respectively, while those producing various skin irritations are mentioned in Appendix IV. Appendix V lists those causing hay fever and Appendix VI summarises the pathological disturbances caused by particular species.—M. H. French.

358† McCulloch, A. W. and Schrunk, J. F. **Sprinkler irrigation.** 1st edn. 1955, pp. 466, bibl. in text, illus., Washington ; Sprinkler Irrigation Ass., 28 × 22 cm., $6·50.

As the use of irrigation extends in American agriculture there is an increasing need for more thoughtful use of limited supplies of water. Sprinkler irrigation is becoming more popular, for a sprinkled area, estimated at 3,000,000 acres in 1954, is increasing at the rate of 500,000 acres a year. This loose-leaf book is a first attempt to bring together the best available information on the agronomy and hydraulics of sprinkler-irrigation systems : as knowledge accumulates the book will be modified.

On the engineering side there is a very much extended and detailed survey of the topics dealt with in our own Ministry of Agriculture Bulletin No. 138 (*Irrigation*). On the agronomy side there is a lot of information that we are only now beginning to collect ; fixed and operating costs of equipment ; water requirements of different crops ; and results of irrigation in the field, both in terms of crop yield and financial return. With a little care, much of this American experience can be converted into British equivalents, so that those here who want to know what to do and how to do it can find a lot to help them. With more care, needed because of the climatic differences, the results can be used as a guide to what might be achieved in south-east England on similar crops.

Though the price is somewhat high the book should be part of the library of anyone concerned with irrigation engineering, the water requirements of plants, or the potentiality of irrigation as a method for increasing food production.—H. L. Penman.

359† Frear, D. E. H. [Ed.] **Pesticide Handbook 1956.** 8th edn. 1956, pp. 208, Pennsylvania; Coll. Sci. Publ., 23 × 15 cm., $1·25.

This most recent edition follows the pattern of previous issues. It contains the names of 6111 products. A list of pesticide tolerances, those established up to 1 Feb. 1956, with the names of the crops covered, is included for the first time.—M. Pennington.

NEWS ITEMS AND NOTES

Netherlands

360 New Crop Land. The final closure surrounding the third polder to be reclaimed from the former Zuyder Zee was made in September, 1956. East Flevoland, as it is named, is described and mapped in *V.C.S. Bode* 1956, **9**, No. 9, 105–7. Not only is it the largest of the new polders, for its area is approximately 135,000 acres, but it is believed that it will be one of the most fertile in the Netherlands, having 96% " very good soil " as against 70% and 80% recorded for the Wieringermeer and North-east Polders, respectively. Pumping, now in progress, will last for some eight months. When the land becomes suitable for cultivation, beet-growing is expected to be of importance.—G.M.R.

Germany

361† Crop-Residues in Soils. The average application of dung in Germany is 3·5 tons per ac. p.a., which supplies about 20 cwt. of dry matter. The total amounts of dry matter contained in the residues of particular crops, to a soil depth of 10 in., are approximately (in cwt. per ac.) :

3-year lucerne 75 (in roots 40) ; 1-year ley 26 (18) ; field beans 18 (13) ; winter wheat 13 (7) ; spring barley 8 (5). In the case of deep-rooted crops, the deeper soil layers contain significant amount of residues. *Betriebsw. Nachrichten* July 1956. [From *Agric. Rev.* 2, No. 5.]

Czechoslovakia

362 Seed Exchange. The Central Agricultural Library of the Czechoslovak Academy of Agricultural Sciences has forwarded to this Bureau an *Index Seminum* of seed offered in exchange during 1957–8 from the Research Institute for Plant Production, Ruzynë near Prague, (founded in 1951). The material includes species from the Cruciferae, Chenopodiaceae, Leguminosae and Gramineae (cereals).—M.H.

Sweden

363 Hemp Production on the Island of Gotland. The island has about 15,000 ha. of marshland, the greater part of which is suitable for the growing of hemp. The present area under hemp is about 1000 ha., and gives a crop of some 5000 kg. straw and 200–300 kg. seed per ha. Processing is done by modern plant at Visby under the control of a co-operative society, the Gotland Hemp Growers Association of 650 members. An illustrated account is given in *Lin* 1956, **10**, No. 3, 41–7, English summary .—G.M.R.

364 Seed Production. In *Svensk Frötidning* 1956, **25**, No. 2, 24–6, Professor G. Nilsson-Leissner reviewed the 1956 home-grown, spring seed supplies and their quality, especially as affected by the abnormally dry summer of 1955. Of the cereals, oats suffered most from the drought, and really well-developed seed could be expected only from western Skåne and Halland and from moist localities such as old lake bottoms and fens. A scarcity of certain oat varieties was expected, even with the import of Swedish varieties from Denmark. The cereal least susceptible to drought and heat is two-rowed barley, and seed crops, satisfactory in quality and quantity were available ; but six-rowed barley reacted unfavourably and often had a shrivelled appearance with thin, dried grain. In addition, mechanical injuries paving the way for fungous attack contributed to lowering the quality of this seed. Spring-sown wheat suffered much from the drought : it was small-grained, and, although germinating well in the laboratory, was then to a great extent attacked by mildew. A contributory factor towards the attack was mechanical injury received in threshing, especially in combine threshing. Disinfection with Betoxin TD and TMTD was recommended. Of peas and vetch a small and small-seeded seed crop was obtained, of very variable quality ; but adequate quantities of seed of roots and spring-sown oilseed crops, of normal quality, were available. A general analysis of the year's seed crops revealed an increasing amount of adulteration from other crop plants, and, more dangerously, from wild oats, and of mechanical injuries produced in threshing. In the same part of *Svensk Frötidning* an account is given of seed production in Skåne, Blekinge and South Kalmar, pp. 18–22.—G.M.R.

USSR

365 Atomic Way to Raise Cotton Yields. In Uzbekistan during 1955, 20% more cotton was harvested from plots where radioactive elements were introduced into the soil before sowing than from those where only mineral fertilizers were used. Cotton ripened 7 days earlier and first-grade cotton-yield was 50% higher. *Indian Cott. Gr. Rev.* April 1956. —J.F.C.

Kenya

366 Synthetic Maize Varieties are being developed by the Department of Agriculture, by combining a number of high-yielding early generation inbreds and allowing natural crossing and increase. One variety, bred at the Plant Breeding Station, Njoro, was released to farmers in 1956 and another variety from Kitale will be issued in 1957. Compared with local varieties, the synthetic variety has a decided advantage in greater uniformity for type and size, better-covered tips, and in freedom from disease. Synthetic varieties are also more suited than hybrid maizes to African farming. *K.I.O. Fortnightly* March and July, 1956.—M.P.

Pakistan

367 The Pakistan Institute of Cotton Research and Technology was opened in March 1956, by the Prime Minister of Pakistan. The Minister of Food and Agriculture expressed appreciation for the generous help given by the United Kingdom through the Colombo Plan and for the equipment supplied by the International Co-operation Administration. Four 3-year post-graduate scholarships in cotton technology have been provided by Pakistani textile firms. *Pakist. Cott. Bull.* April, 1956.—D.B.

Australia

368 Radioactive Treatment for Barley is being carried out at the Waite Agricultural Research Institute, South Australia, in an effort to improve barley quality. It is hoped the treatment will result in strong plants which are more disease-resistant and better able to stand up to wind and rain. The changes in the growing plants will be observed by means of an X-ray machine. *World Crops* August, 1956.—M.P.

369† Seed Exchange. The 1956 list contains nearly 1000 species of grasses, legumes and miscellaneous plants available from the Principal Plant Introduction Officer, Division of Plant Industry, C.S.I.R.O., P.O. Box 109, Canberra. The varieties of sunflower, oats, barley, groundnuts, soya-bean, pea, cowpea and sesame available, and their source of origin, are listed in the appendices.—M.P.

370 Hazeldean—The First Victorian Linseed. This variety is immune to all Australian races of rust and is highly resistant to wilt. In many respects it resembles the commercial variety, Walsh, but in 9 trials over the past 5 years, the average yields of Hazeldean and Walsh have been 19·5 and 14·7 bu. per ac., respectively. *J. Aust. Inst. agric. Sci.* Sept., 1956.—M.P.